

The TOOL ENGINEER

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Equipment



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and many other
features



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DETROIT



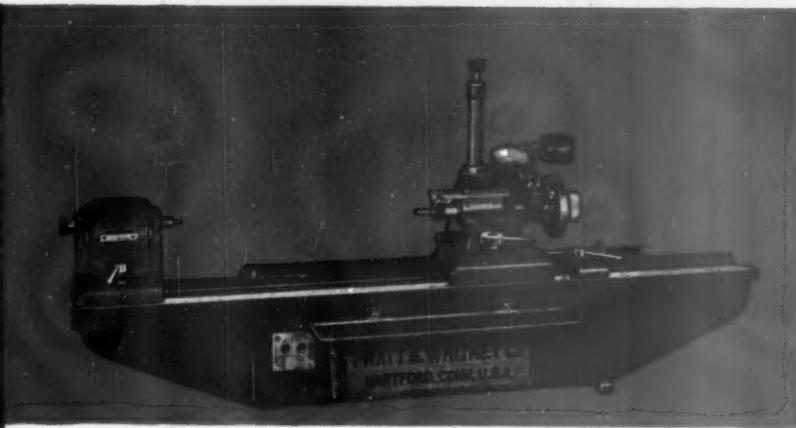
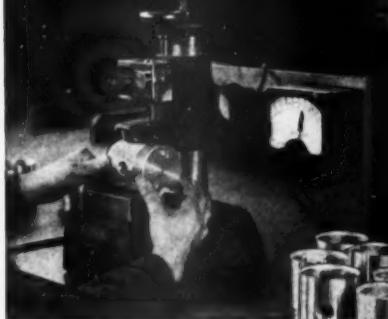
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Further details on page 26

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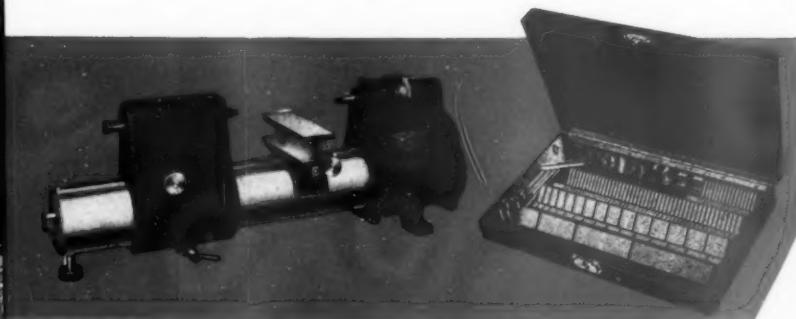
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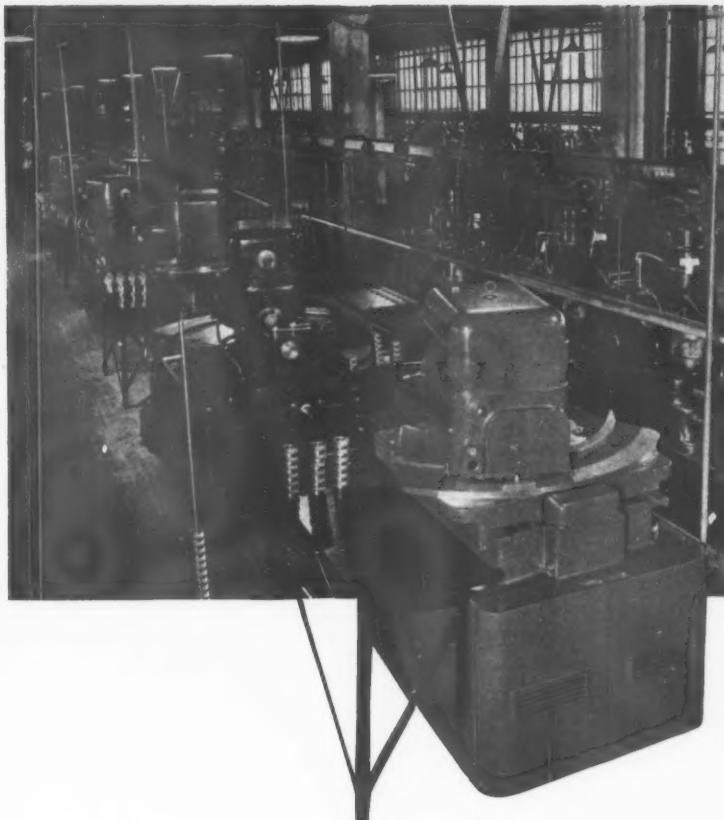
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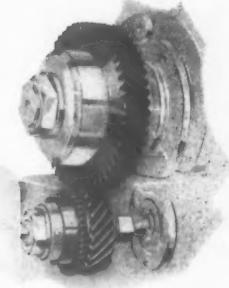
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The Tool Engineer

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Official Publication of the AMERICAN SOCIETY OF TOOL ENGINEERS

Vol. VII

MAY, 1938

No. 1

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Owing to the nature of the American Society of Tool Engineers, a technical organization, it cannot, nor can the publishers be responsible for statements appearing in this publication either as papers presented at its meetings or the discussion of such papers printed herein.

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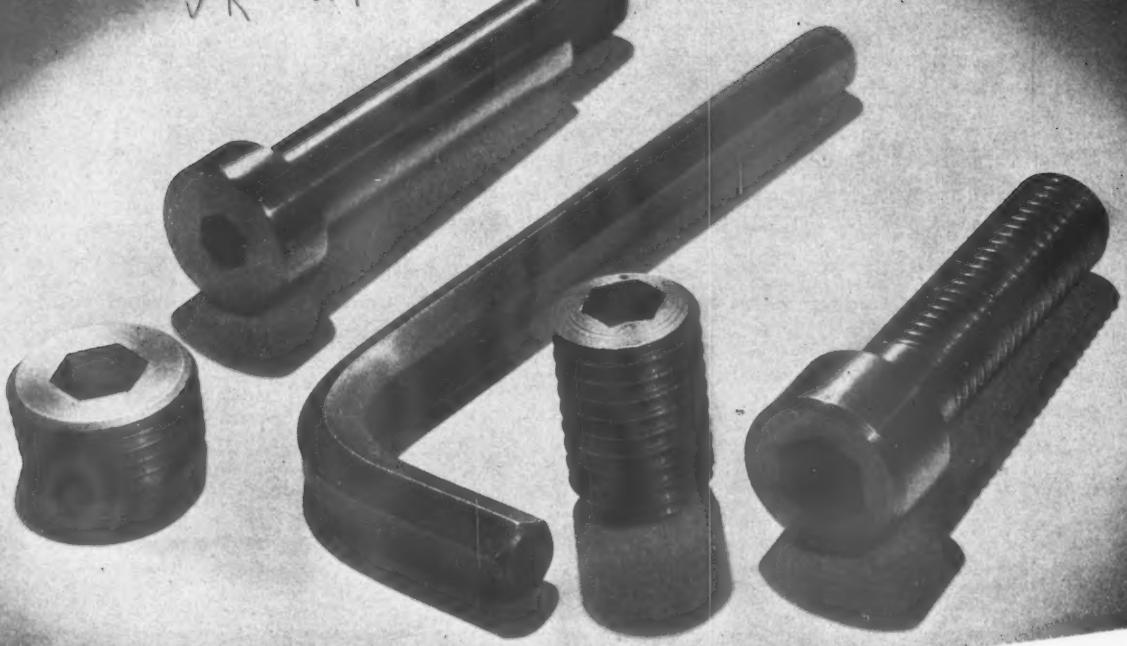
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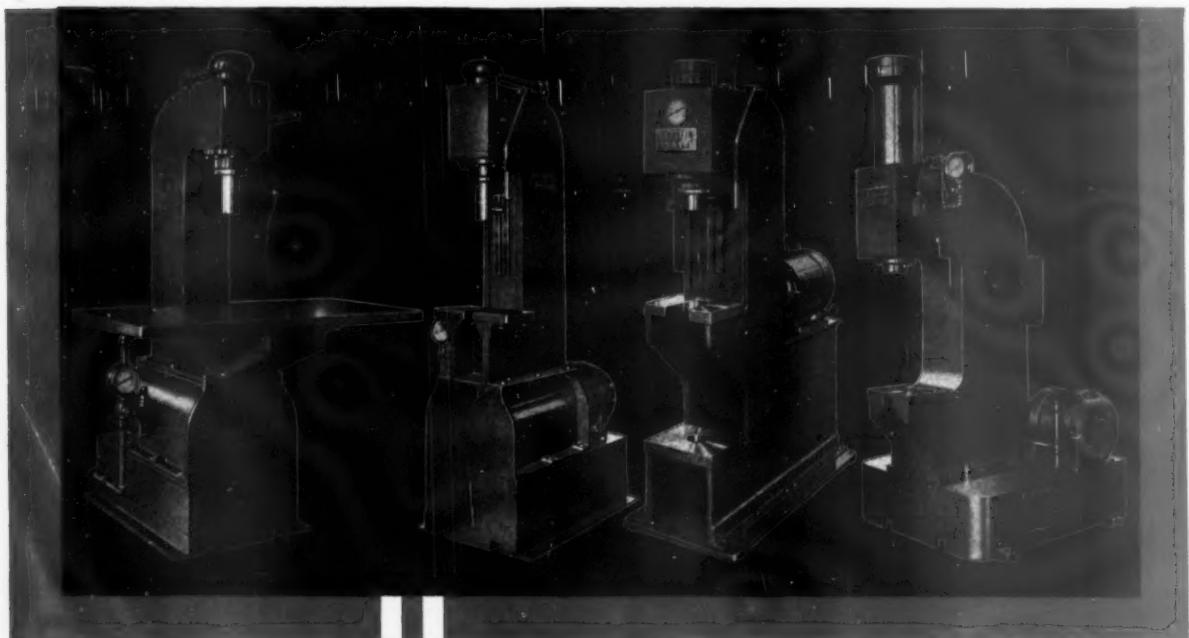
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MESSAGE FROM THE PRESIDENT



OUR Society has passed through the sixth year of its existence; six years of steady and remarkable advance which began with just a small group of tool designers and engineers discussing a plan to organize, meeting periodically to promote further education and recognition in the science of their own vocation. This commendable plan successfully established our Society.

During the past year our greatest strides have been made in not only registering more members, but by adding many new chapters throughout the United States. Coinciding with this growth, we have created priceless good-will in the Machine Tool and allied industries in this country.

The members of this comparatively young Society should indeed feel proud of the tremendous progress made, and I personally am convinced that we are only in the infant stages of what promises to culminate in one of the most prominent and important Engineering Societies ever founded.

Considering the immense field of eligibility from which our membership is selected, we are destined to make rapid strides toward expansion. This encouraging growth, however, only stresses the importance of exercising caution in the admittance of new members. The Society could be flooded with non-qualified members should we slacken in our investigation of applicants, and thereby lose its identity as a Society of Engineers solely for the promotion of engineering. It is essential, therefore, that the membership keep this foremost in mind, as this alone will maintain the standard for which it was conceived.

Profound congratulations are due our organization for having so successfully staged the recent "MACHINE & TOOL PROGRESS EXHIBITION" in Detroit. It was considered a very bold step in the beginning with numerous drawbacks, but I am proud to say the tremendous success of this immense undertaking hinged on the courage and determination typical of engineers to execute a practical idea. This show undoubtedly was the great-

est forward step we could possibly have taken to place our organization where it rightfully belongs in respect to industry. Volumes could be written about this exhibition, in which nearly one hundred seventy-five manufacturers of various lines of equipment and tools evidenced confidence in this young Society to gamble with us in the display of their products.

What made this Show a success? My only personal answer is that it was unique and different because it was staged not by the makers of these products but by their users. This particular set-up attracted approximately 30,000 attendants because it removed the usual expectancy of over-indulgent commercialism which was not as dominant as the educational enlightenment of new and modern products.

I want to personally thank all the exhibitors for their confidence in our Society; their assistance naturally was essential to make this show a success and I wish to assure them of the Society's good wishes for an unlimited measure of satisfaction and benefit for their efforts. We are receiving, daily, flattering letters about the show,

and these compliments have forced our decision to hold a bigger and greater display in 1939.

I wish to assure the Directors of my appreciation for their confidence in electing me to the highest office in this Society. I regard this a great honor and recognize the responsibility which it carries. My best judgment will be exercised with the assistance and cooperation of my fellow officers in guiding the Society successfully through another year.



WALTER F. WAGNER

Newly elected President of A.S.T.E.
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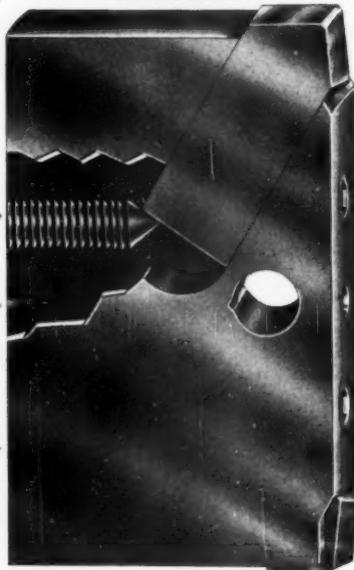
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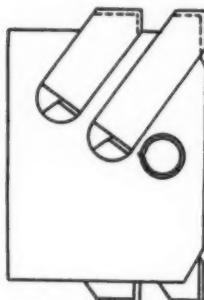
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SELECTING and BUYING EQUIPMENT

The title of this series suggests its vital importance and interest to the Tool Engineer everywhere. On the following pages we give you the viewpoint of the Tool Engineer, the purchasing agent, the shop man and the supplier. All of these papers were presented at the technical session of March 10th during the recent A. S. T. E. Annual Meeting and the Machine & Tool Progress Exhibition, Detroit, March 9-12.

From the Standpoint of the Tool Engineer

"**H**AS industry solved the problem of selecting and buying machines and equipment? Does the responsibility belong to the Purchasing Department or Master Mechanic or does it belong to the Process Engineer, known also as a Tool Engineer? Or does this responsibility belong to the Plant Engineer or does it belong to the Time Study Department or Plant Layout Department? Perhaps this responsibility belongs to the Department Foreman or the Plant Manager. I think most of us here tonight will answer that question with 'No.' Decidedly 'No.'

"I think we would say that this responsibility belongs to many Departments, each having its specialized duties to perform in order that machinery and tools may be selected and purchased with the greatest amount of knowledge and information. In selecting and purchasing equipment the Tool Engineer, who is also known as a Process Engineer, is charged with the responsibility of planning various operations necessary to complete the part, of selecting the one best method to adopt, after assigning the equipment required to go with the tools, fixtures, gauges, and other supplies necessary to complete this process and he is also responsible for the elimination of the various troubles and failures which occur in actual production. The Process Engineer has many things to consider in lining up a process. He must know the capacity required for this particular part. He must know the investment necessary for a given capacity. He then is in a position to proceed to line up and visualize the operations necessary. He then can visualize the tools and the fixtures and the gauges necessary. He can set forth the sequence of the operations, the accuracy of the operations and the amount of metal to be removed at each operation. He must consider heat dissipation, the loading height of the machines, the probable production from each operation of this machine, the safety and the cleanliness. Cleanliness means good housekeeping and good housekeeping means everything on the job that is necessary and a place for everything. He must consider the elimination of bottlenecks in the line. I do not know whether you all know what a bottleneck is, but it is the machine in the line that is incapable of producing enough pieces to keep up with its predecessors or successors. He must have a knowledge of speeds and feeds, loading time and unloading time of the part. Those are a few things that are necessary in order to arrive at a process.

"The Tool Designer's portion of this job of selecting and buying machinery consists of designing tools, fixtures and gauges necessary to complete this process. It is quite necessary that the Tool Design Department know the length of time to be allowed to load and unload the fixture many times. This shows the need and the necessity for an easier, quicker, and more

By EDWIN H. JOHNSON

MANAGER OF COST STUDIES
PACKARD MOTOR CAR COMPANY
MEMBER A.S.T.E.



MR. JOHNSON

simple method of holding and clamping. So we find it quite desirable for the process man to confer with the Time Study man and state this length of time on the Tool Order which this Tool Design Department uses as their authority to design the tool. Tool design has many other things to think about. The method of holding, how many clamps to use, the special tools required by this process, the standard tools required, how the fixture can be cleaned, and the accuracy. He must also think about whether this tool has the accuracy desired and required and is the fixture fool proof or do we have to run the hazard of loading it incorrectly and producing an imperfect part? Can the wear parts of the jig be replaced easily, quickly and economically? We should not minimize the importance of tool design in selecting machinery.

"It is a function of the Time Study Department to determine the proper speeds and feeds for each operation to be performed as well as to determine the number of pieces to be produced by each tool before regrinding becomes necessary. Therefore, in selecting and purchasing equipment, Time Study is given the opportunity of determining the speeds, the feeds and the number of pieces per grind which later become their only gauge to equal or exceed in actual production. From this information the Time Study will also measure the production to be expected from the proposed machine. Time Study has many other functions. It is the responsibility of the Time Study Department to obtain the maximum capacity production from each machine provided that maximum capacity is required. It also is their responsibility to set up the floor—floor or cycle time for this operation or this machine and to this floor-floor or cycle time, add such allowances as may be necessary from their ex-

perience. Some of these allowances I will enumerate as follows: Tool changes; how many times you change a tool and how long does it take to do it; breakdowns; either mechanical or electrical; scrap, (you may say we do not make scrap but we do); oiling; and oiling the machine. I am just bringing out a few of the ones that are thought of the least. Further allowances are removal and replacing of coolants in the machine. When the Time Study add these allowances to the cycle, or floor-floor time we then have the production per hour per day rated. This is all based and set up on the basic knowledge of speeds and feeds and loading and unloading time. Cutting speeds and cutting feeds vary in different plants due to the different kinds of material. It varies in the same plant among different parts. We will take, for example, using stellite steel on soft iron. We find a variation of from 120 feet to 180 feet a minute, a minimum of 120 feet and a maximum of 180 feet. This is a difference of 60 feet or 50% based on the minimum or a third based upon the maximum. We must have an exact knowledge of the exact cutting speed we are going to use in order to arrive at the cycle time which determines the production per hour from this machine.

"The functions of the Layout Department are to plan the location of the various machines as set forth on the Process routing, in order to set these up so they can be operated with the greatest economy. They must consider the size of the machine; the weight of the machine; special floor if required; ventilating problems and the operator's position on the machine. These are all problems of the Layout Department and therefore, we find it desirable that this Layout Department aid in selecting machinery.

"The Plant Engineer is responsible for all electrical equipment used in the plant and therefore, his standards should be observed in selecting and buying equipment, inasmuch as he is responsible for the proper installation of both machinery and electrical apparatus. He should always be consulted with reference to the various installation problems.

"The Plant Manager and his Foreman are charged with the responsibility of operating the equipment selected and of securing the results for which it was intended and, therefore, these individuals should be consulted. Quality, quantity, economy, safety, cleanliness and the elimination of the alibi between these divisions are a measure of machine satisfaction to them.

"Naturally, the functions of these several Departments that we have just enumerated are subject to variations in different plants, either combined or enlarged, depending upon the volume, but no matter how large the plant or how small the plant even down to one man, the functions performed still remain as outlined. As we proceed we find the Proc-

ess Engineer first determines the proposed method to be adopted which might be termed a proposed line-up of operations showing the equipment to be used either now available for use in the plant or to be purchased. Upon securing the agreement of the Master Mechanic to this proposed line up, the Process Engineer is now ready to secure quotations on the proposed new equipment. At this point, contact with the equipment or Machine Tool representative is made directly by the Process Engineer or through a machine specification Engineer, who explains the problems involved in detail. He furnishes the Tool Representative with the proposed line-up which is required. Generally quotations for the new machinery may then be handled in the following manner:

"First, we desire quotations on the proposed line-up. Next, we will consider quotations on any alternative line-up, either in part or entirely which might utilize that particular machine tool to the best advantage and through this procedure a picture is obtained of all the machines that the tool industry has to offer, together with their ideas on how they would do the part and how they would plan the operations. With this information the Process Engineer can then compare and combine the equipment now in his plant with the numerous methods proposed by the best that the market has to offer. These facts will enable him to determine a process on each plan, judge its advantages and disadvantages, and eventually decide upon a method most suitable from every angle. When the foregoing analysis is complete, the next step is to analyze the various quotations to determine the exact machinery to be specified. Some of the more important characteristics to be considered in analyzing these quotations are as follows: 1—The general operation characteristics of the machine. 2—As we look at this quotation we ask ourselves is this design new? 3—Has it ever been built before? 4—Are there any in operation and are they operating successfully? 5—Just what are the new features? 6—How much development work will this machine require after being built for this job? 7—The method of holding the piece as specified in the quotation. 8—Is the piece to be hand clamped, hydraulic clamped or air clamped? 9—Are we sure we will not distort the piece in clamping? 10—How many pieces per setting, one or more than one? 11—What is the advantage of one or more than one? 12—What tools do we propose to use? 13—Is it standard tools or special tools, fixtures and gauges? 14—Is our cost to replace the tool going to be conventional or otherwise? 15—Is our cost to resharpen going to be conventional or otherwise? 16—What is the probable number of pieces before this tool becomes dull? 17—Have we definitely established the proper feeds and speeds for all special tools? 18—What is the condition of the

rough stock? Is it variable or stable? 19—Has our experience been on this particular part that it comes within the limits of hardness or does it lean over toward the high side? This last question helps to determine whether we take the high point of the speed and feed or the low point and within what limits.

"Further analysis requires consideration of the following questions: 1—Are we going to cut scale? This determines our tool life and in turn determines speeds and feeds to a great extent. 2—What is the feeding mechanism of this particular machine? Is it mechanical, hydraulic, or hand feed? 3—What kind of electrical equipment is quoted? 4—What is the horsepower of the motors? 5—What is the rating? 6—How many of them and are they built in or attached? 7—Can changes be made due to breakdowns or have we got to replace with the same motor? 8—What starters and wiring are we proposing? 9—Are they accessible or are they standard or special? 10—In analyzing these quotations we look at the coolant, the kind of tank, the size, the piping, the pump, and the lubricating of the machine and we ask ourselves what kind of coolant is proposed? 11—Is it a dark cutting oil or is it multi-fied or soluble oil? 12—Is the tank to be large enough and is the piping designed so as to be accessible or is it just to be put on the machine? 13—Where do the chips go and what kind of pan is used? 14—Does the machine have to be idle while we are cleaning the chips? 15—Will the pump be in such a location as to pump clean coolant? 16—Will the pump give us good life and service? 17—How is the machine oiled and will this cutting oil get into the bearings of the machine, or vice versa, or get on the floor? 18—How are the fixtures to be cleaned, by brush, by air, by oil, or by hand? 19—Is it necessary to instruct an operator specifically how to clean the fixtures or will it be obvious? 20—How accessible is the machine or tool changes? 21—Can the tools be changed readily or do gauges have to be used? 22—How long will the machine be idle for a tool change? 23—Do we propose set-up masters?

"Under the subject of machine repairs we must consider the following questions: 1—Has it been our experience that this machine is subject to extensive repairs? 2—Can the repair parts be secured promptly? 3—Is the machine adaptable? 4—Can repairs be made without moving it from its present location, to a crane, we will say? 5—Will it be necessary that we stock repair parts in the stock room? Consideration of the last five questions should be based on past experience of this type of equipment.

"We should know the number of cutting tools and we should know definitely what our experience has been in the number of pieces per grind and the number of grindings per tool. We should know how long any tool will last before resharpening and how many per day. I might bring out some facts on cutting tools and the average six cylinder block in an automobile. If we had 29 machines to machine this cylinder block to obtain a certain production, we find 959 cutting tools all working at once, or 33 cutting tools per machine. 959 is not far from 1000 and if we produce 30 blocks an hour, that means approximately 30,000 tools cutting every hour. Proper specifications of speeds and feeds is very important in estimating tool life and production per hour.

"Next we should consider the safety features of the proposal. Can it best be loaded and unloaded without the hazard of crushed fingers or cuts? Gentlemen:

there is one thing we cannot stock and that is extra fingers. Does the chip removal present a hazard or is it easy? Will we have to furnish the operators with protective clothing, gloves or goggles? Will we require special gauges or fixtures to resharpen special tools or will we require special machines to sharpen these tools or have we now got them in the plant? We have to answer that question too.

"How about the adaptability of the particular machine for the plant layout? Will the machine fit into our present layout? What changes will we have to make? Will we have to change the sequence of the operations? Will the loading height correspond to the balance of the machines in the Department? Is this particular line-up going in a first floor department or multi-story building? Will the machine be delivered on the specified date and what is the price of the machine? Are we sure of the weight of the machine?

"When these items have been analyzed and comparisons made of the various quotations submitted and the selections made, the actual purchase requisition may be written which should be approved by the Master Mechanic, by the Process Engineer, by the Plant Manager and his Foremen and the Plant Engineer. It then may be forwarded to the Purchasing Department together with a copy of all the quotations we received on that machine. The Purchasing Agent will determine to his entire satisfaction the correctness of those requisitions, whether or not the order should be placed and his investigation will determine if the vendor's price is acceptable, if the delivery is possible, if the patent rights, if any, are acceptable, if the financial status of the vendor is acceptable and in general, thoroughly alter any phase of this order he so desires. Upon the satisfactory completion of this investigation, the Purchasing Agent then places the purchase order with the vendor for the equipment quoted. The purchaser will state whether or not the tools have been ordered with the machine. The vendor is then obligated to present his design, in sufficient detail to be analyzed by the Tool Design Department, the Process Engineer and the Master Mechanic, who will either accept them or revise them to meet the conditions and the results desired. With this approval, the vendor may proceed to complete his Tool design work and often times even complete the machine's design work and proceed with the actual making of the machine and tools.

"Taking the hypothetical case of a purchaser receiving a machine in his plant, we find it is installed by the Plant Engineering Department in the location determined by the Plant Layout Department and operated at the speeds and feeds determined by the Time Study Department, but the jigs and fixtures are approved by the Process Engineer with the full expectations of securing the result originally planned and rightfully so if the selecting and buying program is carried out to its fullest extent. If the Process Engineer is unable to secure the result planned, he is in a position to go to the exact department who is responsible and who will be responsible to correct the failure and obtain the results anticipated.

"The ability of the vendor to work with the Process Engineer and the Plant Supervisor during the early life of this machine is of paramount importance since these few months of operation will tend to prove whether a wise and preferable selection has been made. There is always a tendency for an organization to be influenced by the

(Continued on page 44)

A.S.T.E. LOCATES IN BOULEVARD TEMPLE BUILDING

Room 428 Boulevard Temple Building, 2567 West Grand Boulevard, Detroit, Michigan is now the address of National Offices of the American Society of Tool Engineers.

The removal to the new location was forced by the rapid growth of the Society and the consequent need for considerably larger quarters. The new telephone number is TYler 5-0145.

SELECTING and BUYING EQUIPMENT

From the Shop Viewpoint

"Mr. Chairman, Mr. Johnson, and fellow members of the American Society of Tool Engineers.

"Mr. Johnson, in his paper just read, has so thoroughly outlined the ideal procedure, the functions, the coordination, and the responsibilities of the various departments concerned that we can well accept it as a standard procedure.

"Mr. Johnson in giving you his outline of methods to be followed in selecting equipment has placed great responsibility upon the tool engineering department, or you boys the Tool Engineers of the industry. At this point I would like to express my surprise and gratification at the success of this first American Society of Tool Engineers convention. It appears to me as being a very, very fine meeting and is indicative of your position in the industry.

"In the remarks I am about to make I wish to outline to you the condition that exists in the aviation industry which is a new industry and in no sense can be compared to the automotive industry and the mass production problem as you are acquainted with them. Our problem is different from yours in many ways, while the basic principles upon which equipment is to be provided are the same. For instance, our problem is to provide the most reliable engines possible, delivering the greatest possible horsepower for the least possible weight and having the greatest economy. We have been successful in producing an engine capable of delivering power at the rate of very close to one pound per horsepower. During the war two pounds and four-tenths per horsepower was a good power-weight ratio.

"Now developing of our products to obtain this high power-weight ratio has called for very fine engineering and the development of very fine materials, superior heat treats, mirror finishes on wearing surfaces, etc., all of which has made the machining problem that much more difficult. This problem has been a challenge to the ingenuity and the efficiency of the Tool Engineer, who has met it by providing better tooling, better methods, better equipment, capable of producing parts of superior strength, finish, and accuracy, which has made it possible to produce modern aviation engines capable of delivering about twice the horsepower for the same weight and displacement and at very little increased cost. In our industry we are also constantly confronted with the necessity for changes and improvements. As you all know by reading the trade journals, the ships are getting larger every year and the power plants are growing. They had to be developed together. We had to obtain the most efficient combinations possible. Which means in our work that we are never set on a design. As a matter of fact, we hardly ever produce two contracts alike. I only mention this to lead up to the point that a shop man's problem in an aviation factory is different from the problem you are used to dealing with and studying.

"While we consider an order of 250 large aviation engines per month a very large production order, it cannot be compared with your production problems. Special equipment is considered only on mul-

By P. W. BROWN

WRIGHT AERONAUTICAL CORPORATION
MEMBER A.S.T.E.

iple plant or multiple parts common to more than one model. Therefore, in the selection of new equipment for the Wright Aeronautical Corporation's factories, we consider most important the volume of production, accuracy, and finish required. And I might add to this point that the accuracy is the most important item of all to be considered.

"As parts are scheduled through our production lines in relatively small quantities and with the many changes, our equipment must be purchased flexible enough so that when parts are obsolete and superseded they will be within the range and capacity of the equipment with only normal tool changes necessary. When more productive machines of more or less special nature are required, an effort is made to have them constructed of standard units which can be altered or rearranged in groups to suit following models or changes. By this method the cost of model changes is held to a minimum.

"In discussing this paper from the viewpoint of the Tool Engineer and shop man, various pertinent factors must be given consideration. For instance, the volume of parts to be fabricated; whether they are to be fabricated departmentally or by progressive line production; whether suitable equipment is available or being provided; time required to perform the operation; quality of finish desired and accuracy required. If departmental manufacturing has been decided upon, a very careful study is made to hold the unit cost to the minimum and to warrant the expense of the equipment involved. Where parts are used in multiples, or common to more than one model, production is higher and equipment is selected accordingly. If progressive manufacturing has been decided upon, the longest time operations in the production line are carefully considered and every effort is made to hold these times to a minimum, and the remaining equipment selected for the work shall be capable of easily maintaining the flow of production but need not be of greater capacity than to keep up with the line. I might add at this point that we do use mass production equipment in many progressive lines. For instance, in our cylinder head and cylinder barrel lines we have a battery of seven Bullard Multimatics, six Fay Automatics, and a Hall Planetary Thread Mill.

"When a new product or new parts are to be fabricated, the process engineer tentatively prepares the method on operation sheets after which the committee composed of the process engineer, time study representative, chief tool designer, and department supervisor are consulted, and if recommendations for changes are made, either on method or tooling, they are considered and approved if accepted.

"After the method of operation and the necessary new tooling have been approved, the process engineer then permanently prepares the method of operation on operation sheets and by the use of tool sketches, the tool designer is acquainted with the

procedure, then accordingly designs the tools which are ordered through tool requests and sketches from the process engineer.

"The selection of equipment should be performed by a committee composed of a representative of the standards department, production engineering department, and manufacturing department. In the exercising of these functions, in nearly all cases, alternate methods and equipment proposals are considered. After recommendations for equipment have been made by them, final approval should be made by the master mechanic.

"When new machine tool equipment is required, the process engineer makes his recommendation to the supervisor of the production engineering department who provides the machine tool manufacturers with all information concerning the operation to be performed, furnishing them with operation sheets, operation sketches showing the condition of the part at the time the operation is to be performed, and blueprints; also requesting from them their recommendations, quotations, delivery date of equipment, and time required to perform the operation. And at this time I might state we have found that we obtain the most valuable information and greatest help from the various equipment vendors. They know the capability of their machines probably better than we, and we try never to fail to take advantage of their experience and recommendations and in many cases have profited immensely by the saving effected by their recommendations.

"It is necessary for the production engineering department to schedule the completion of operations, the designing and procurement of tools to be available by the time the machine equipment will be installed. After the various proposals have been submitted from the machine tool manufacturers, the supervisor of the production engineering department makes an analysis of the same and prepares a summary report which shows the comparative features of each, also the cost of the equipment, delivery dates, time to perform operation, etc. This report is attached to the proposal and is later turned over to the committee who select the kind of equipment to be purchased.

"The supervisor of the production engineering department then turns over to the master mechanic the selected proposal for final approval. The accepted proposal is returned to the supervisor of the production engineering department who signs the purchase requisition and secures the signatures of the master mechanic and works manager. He also notifies the layout supervisor of the necessary space required for the new equipment, giving all pertinent information, and issues orders to the plant engineer for monorails, conveyors, lights, ventilation, exhaust system, if, and as necessary.

"These requisitions are attached to the selected proposal and turned over to the plant engineer, who checks the electrical equipment recommended by the machine tool manufacturer and makes recommendations for changes, if necessary, also prepares the proper space for the new equipment.

(Continued on page 47)

SELECTING and BUYING EQUIPMENT

From the Purchasing Agent's Viewpoint

MR. CHAIRMAN, Gentlemen. It is indeed a privilege to be invited to take part in a meeting of Tool Engineers.

"Mr. Johnson's admirable paper emphasizes the many complexities involved in machine tool problems in a large automobile concern. The story of the automobile industry in this regard is essentially and fundamentally the story of all other basic industries, for machine tools represent fixed capital investment, return from which is about proportional to rate of output and cost per unit produced.

"Every machine requires human attendance and service in greater or lesser degree. Material to be machined, cutting tools, gages, jigs and fixtures and necessary equipment of non-durable and miscellaneous shop supplies must be provided. An operator must be assigned to it, proper working conditions established, and arrangements made to bring work pieces to the machine and take finished pieces away. Thus the planning for maximum results, as Mr. Johnson so clearly points out, involves consideration of several major factors, all of which must be recognized and properly coordinated.

"As I am, a purchasing man, and not an equipment engineer or factory supervisor, my remarks must be confined to observations derived from day by day experiences in consummating purchases for all machine tool equipment for use in General Electric factories. With approximately 25,000 machine tools in its plants, the General Electric Company may be said to be a very large user of such equipment. The various Works of the Company comprise, as most of you gentlemen know, a number of self-contained plants, each with its own works manager and assistants. Various di-

By T. P. HIGGINS
GENERAL ELECTRIC COMPANY

visions differ in type of manufacturing activity from mass or continuous types, as in the manufacture of refrigerators, fractional horsepower motors, meters, etc. to shops or intermittent production or jobbing type, as in the building of large turbines, generators, transformers, oil circuit breakers, etc. Hence, our experience as a machine tool user may truthfully be said to include practically all types and sizes of machines.

"Manufacturing activities of the great majority of General Electric departments comprise for the most part short orders of a job-shop character. In selecting new machine tools to meet this condition, our preferences are decidedly toward conventional general purpose equipment. Of course, in those departments where manufacturing activities are of the continuous or high production type, we have a very definite justification for operating a considerable number of single-purpose or special machines. A high grade standard unit however, embodying a wide speed and feed range, meets the greater portion of our requirements best, and represents at least 80% of our equipment requirements. Work-holding fixtures on the other hand are designed and constructed as a single-purpose accessory. We go to extreme detail in this regard, giving consideration to every mechanical, hydraulic or pneumatic principle at our command, in an effort to obtain the ultimate from a labor saving standpoint. This combination—a flexible general-purpose machine equipped with adequate single-purpose fixtures—might

be said to be our broad general policy covering machine tool equipment for most of our requirements.

"I have mentioned the fact that each of our plants has its own works manager and assistants. All negotiations for machine tool equipment are handled through the office of the general superintendent of the interested plant, as he is familiar with the applications and performances expected of the equipment to be considered. The General Purchasing Department is informed as to negotiations at their inception. Proposals are solicited from all reputable suppliers, and an analysis made of the merits of each bid. This analysis, together with an indication of preferred proposal is forwarded to the General Purchasing Department located in Schenectady, where final acceptances are made, after the type of equipment, its applications, etc. have been approved by a technical advisor attached to the staff of the Vice-President in charge of Manufacturing. This has been our accepted routine for several years, and has met with much favor not only from our plant officials, but from machine tool suppliers as well.

"Summarizing briefly, our routine is essentially in line with the thoughts expressed in Mr. Johnson's paper, with emphasis in our case on the fact that we are informed as to negotiations at their inception and final acceptances for all equipment are placed by the General Purchasing Department at Schenectady.

"Thank you, gentlemen, for your kind attention, and let me extend an invitation to each of you to come to Schenectady and discuss in detail this very important subject of so many ramifications.

From the Supplier's Viewpoint

"The Purchaser, as well as the Supplier, would profit if tools and equipment were always selected and purchased in the manner so ably presented by Mr. Johnson. Fortunately the majority of our Manufacturing Plants use good judgment in buying equipment realizing that to show satisfactory operating profits, equipment purchases must be carefully studied by all interested parties before a decision is reached as to the tools and equipment to be installed. Mr. Bernard Lester in his excellent book entitled 'Marketing Industrial Equipment' quotes from a survey made by R. O. Eastman, Inc., stating that, '90% of the purchase transactions by industrials covering machinery are influenced by three or more men.'

"There are manufacturers who give all too little consideration to the proper policy that should be pursued when purchasing machine tools, correctly known as 'The Master Tools of Industry,' and the essential tooling equipment necessary for efficient operation. In some cases a single individual shoulders the entire responsibility for specifying the equipment to be purchased, not consulting any member of his organization. This policy may be a suc-

By A. H. d'ARCAMBAL

PRATT & WHITNEY
MEMBER A.S.T.E.

cessful one to pursue in the case of small organizations or where an outstanding individual assumes this responsibility. There undoubtedly would be cases, however, where equipment not suitable for the production of work to the desired accuracy and at a satisfactory manufacturing cost would be purchased.

"Progressive Suppliers today are represented by men who have a thorough knowledge of the product they are marketing as well as a fundamental knowledge of shop operations. These properly trained representatives act as advisors or consultants and recommend their own equipment only when it is at least the equal of any equipment available for the work in question.

"The sales representative or Engineer always is glad to work with as many shop representatives as the purchaser requests. This list should include the individual responsible for results and must have a thorough knowledge of the job in question, be he the process or tool engineer, superintendent, master mechanic, manager, buy-

er, etc. This important individual can give the vendor a true and complete picture, thus avoiding misunderstandings due to insufficient information which results in unnecessary expense and at times installation of equipment not suitable for the work. He also is receptive to suggestions that might be made by the vendor for more efficient operation.

"Mr. Johnson has listed 22 items of fundamental importance in selecting equipment. While 'Accuracy of product produced' is not listed as a separate item, we presume that this is covered in the fourth item 'Tools proposed.' A qualified vendor will stress the importance of specifying the accuracy of the product to be manufactured, possibly resulting in a discussion with product and Tool Engineers, manufacturing and inspection departments. It is much more satisfactory and efficient to get all departments on the same wavelength before the equipment is purchased than to neglect this important item, resulting in the problem of trying to fit tolerances to the machine after installation. Never lose sight of the fact that a product is no better than the machine it is made on. (Continued on page 38)

HYDRAULIC EQUIPMENT

Including the *Oil Power Fluid Motors*

By C. H. RYSTROM

SUNDSTRAND MACHINE TOOL CO.

HYDRAULIC operation of machine tool slides or other members has the distinctive features of simplicity, easy application, direct action and self lubrication in addition to reliability and durability. These advantages are well known and the rapid increase in the number of machine tools having hydraulic operating cycles demonstrates the practical value of this operating means.

The performance of hydraulically operated machines in commercial service shows conclusively that hydraulic pressure, correctly applied for operating machine tool members, increases production and cuts costs. The result is that it is no longer a question of mechanical vs. hydraulic operation of machine tools but rather which type of hydraulic equipment to select and how it should be applied.

The conventional method of using hydraulic power on machine tools is to connect a pump to opposite ends of a cylinder controlling the flow of oil by means of valves. This arrangement for feeding slides is too well known to go into any further detail about it here.

Another method of applying hydraulic feed to machine slides is by means of a fluid motor driven by a hydraulic pump. Fluid motors may be of either a constant or variable displacement type, the latter serving to increase the speed range that may be obtained. Variable displacement fluid motors are also used where constant horsepower is desired.

Fluid motors provide, in addition to the hydraulic advantages outlined in the first paragraph of this article, easy and exact manual adjustment to carriages and slides whether the drive is through lead screws or gearing. With piston and cylinder feed it must be borne in mind that manual adjustment in most cases is not practical.

Fluid motors give an infinite range of speeds and simplify the whole problem of power transmission. Smooth and rapid acceleration is available when rapid traverse is required and extremely smooth feed is provided for machining operations.

The main drawback to wider acceptance of fluid motors in spite of the advantages outlined has been too low a torque for slow feeds and too low a speed range to take care of both speed and rapid traverse. Excessive slippage at slow speeds has been another disadvantage resulting in neither a reliable torque nor satisfactory speed control.

To overcome these difficulties and provide a speed range that will meet the requirements of most machines and in addition deliver the necessary torque at slow speeds, the Sundstrand Machine Tool Co. of Rockford, Illinois has developed a Two-Speed Oil Power Fluid Motor. This offers great possibilities in the application of hydraulics to standard and special machines because the two speeds permit using the slow speed for feed movements to slides, carriages, tables, etc., while the high speed supplies rapid traverse.

This motor is of the multiple piston type with wobble plate and was especially designed for applying feed to machine tools. It has two torque ratings for the two speeds, the high torque developed at the low speed assuring a smooth and positive speed control as well as reliable torque. Slippage has been reduced to a minimum.

The essential operating elements of the motor are the shaft, a set of pistons, a wobbler and a valve plate. The only rotating part is the shaft which runs in anti-friction bearings and carries the wobbler plate. Such an arrangement naturally reduces friction to a minimum and provides a very sensitive element for the pump to drive.

A feed range from 3 to 120 RPM and a rapid traverse rate of 2000 RPM can be obtained with this motor by driving it with the same standard Sundstrand pumps as used to provide feeding movements by means of a piston and cylinder. The feed rate is varied by adjusting the variable displacement feed pump, the rapid traverse speed remaining constant.

The high ratio of speeds together with the two torque ratings meet the requirements of a wide range of feed applications to moving members on machine tools. Another feature is the high stalling torque which is practically the same as the running torque.

The unit shown in the photograph is the Model 4-MC Sundstrand Oil Power Fluid Motor which has a rating of 100 inch pounds per hundred pounds pressure of the slow speed. It is small and compact, being only 6½ inches in diameter across

the face of the flange and 9½ inches over all.

The Sundstrand hydraulic pumps which provide power for actuating either fluid motors or pistons and cylinders are also small and compact and were especially designed for machine tool applications. They consist of a variable displacement pump of the multiple piston type for supplying the feed and a constant displacement Rota-Roll Pump for rapid traverse both being built into one housing. One, two, or three pre-set rates of feed may be obtained, all adjustable from 0 to maximum. The feeds are positive and uniform as the piston pump is built to supply oil at high pressures without pulsation.

Also incorporated in the pump housing are the main control valves and these may be actuated by either a remote hydraulic pilot valve or remote electric solenoid valves. These devices in turn are actuated by the machine slide as it progresses through its cycle—adjustable dogs on the slide being the common means used to trip the hydraulic pilot valve or open and close limit switches to operate the solenoid valves.

The entire mechanism of the two pumps consists of only two revolving parts mounted in anti-friction bearings and driven by a single shaft with the main control valve section mounted between the pumps. The main control valves contained in the housing of the PWX pumping unit include a 4-way directional valve, a neutral valve, a selector valve for feed and rapid traverse, a slow feed valve, a safety or relief valve, and a locked circuit valve.

The locked circuit valve keeps the slide or table of the machine under positive control at all times. No unsteady feeding or "jumping forward" when cutting resistance suddenly diminishes or ceases as when drills break through the work, during "climb" milling operations or during intermittent cutting operations.

Shown in the illustration is a Sundstrand Model 16-X Valve which in connection with a Model PWX Sundstrand Pump and either a Fluid Motor or piston and cylinder, provides two rates of feed and rapid traverse in both directions. Actions of feed and rapid traverse in either direction and stop are produced by dogs swivelling the valve arm. Reverse and automatic change from coarse to fine feed are produced by dogs depressing the plungers at each end of the valve. Skip feeds and complicated cycles in both directions can

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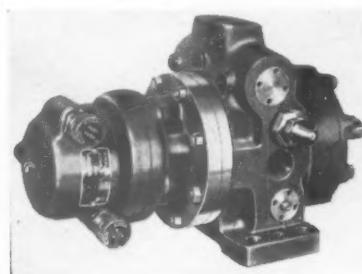


Fig. 1. The PWX Series Pumping Unit.

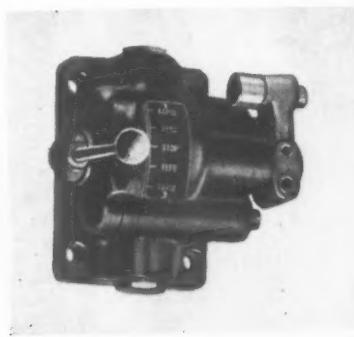


Fig. 2. The 16-X Valve.
THE TOOL ENGINEER FOR MAY, 1938



Fig. 3. The 4-MC Oil Power Fluid Motor.

Standardized HYDRAULIC CONTROLS for Specialized Applications

"Various factors may enter into the operation which will introduce variable stroke lengths, and therefore the hydraulic control must, in certain cases, be one which will automatically compensate for or minimize these factors."

By L. R. TWYMAN

VICKERS, INC.

SPECIAL CONSIDERATION must be given to hydraulic controls when they are to be used to reciprocate the table of grinding machines which must grind to accurate reversal limits. Although hydraulic operation has been adopted by the large majority of the manufacturers of grinding machines, in ordinary surface grinding work accurate limitation of stroke reversal is usually not considered as important a factor as is the smoothness of this reversal. In the average case a difference in table speed may often require a readjustment of the reversing trip dogs to maintain an approximately equal length of stroke. Various other factors also may enter into the operation which will introduce variable stroke lengths, and therefore the hydraulic control circuit must, in certain cases, be one which will automatically compensate for or minimize these factors. Appreciable variation of the point of reversal of course cannot be tolerated when grinding to shoulders, to the end of splines, or to some other similar work obstruction.

The hydraulic control panel shown in Fig. 1 is one which has been developed with the specific idea in mind of positively limiting the length of reciprocating stroke so that overrun cannot take place to appreciable degree beyond a specified point. The difficult problem, hydraulically speaking, is to obtain this result and at the same time obtain smooth reversal action. This panel is also provided with adjustments to enable the operator to obtain a momentary adjustable dwell at each end of the stroke. A start and emergency stop lever is provided at the right-hand end of

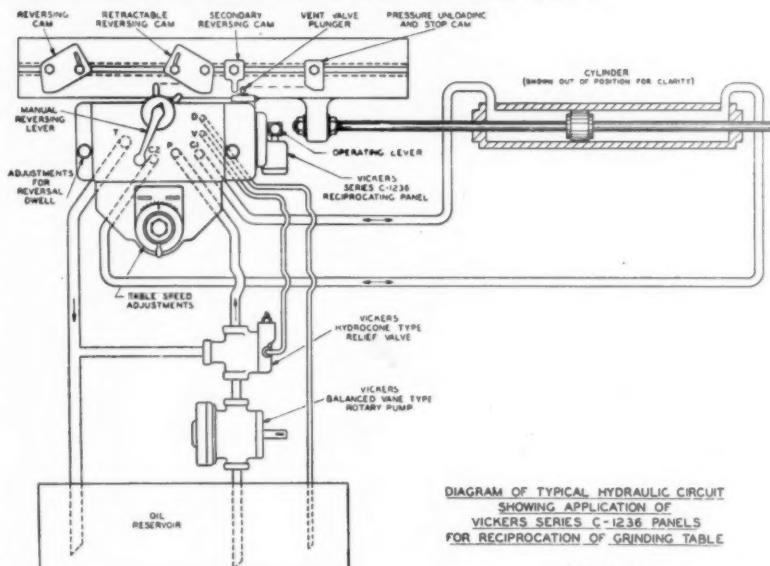


DIAGRAM OF TYPICAL HYDRAULIC CIRCUIT
SHOWING APPLICATION OF
VICKERS SERIES C-1236 PANELS
FOR RECIPROCATING OF GRINDING TABLE

Figure 3.

the panel, an emergency manual reversal lever at the center top, while the dial for regulating the table speed will be noted at the center bottom. This unit is known as the Vickers Model C-1236 Reciprocating Cycle Control Panel. It can be adjusted to give very smooth and very accurate reversals for a wide range of table speeds.

An application of this panel to an unusually large spline grinder is shown in Fig. 2. This modern machine, manufactured by the Fitchburg Grinding Machine Corporation, is arranged for semi-automatic hydraulic operation and will accommodate shafts up to 60 inches between centers with a table type truing device, or 72 inches between centers with a truing device mounted on the wheel head. A hydraulic-ratchet feed can be applied to this machine, as well as other smaller size machines manufactured by the Fitchburg Grinding Machine Corporation, in conjunction with the Vickers Hydraulic Panel.

The typical hydraulic circuit diagram shown in Fig. 3 may be used for a basic reciprocating cycle requirement of the type described. A pressure line from the balanced vane type rotary pump to the panel, connecting lines from the panel to the cylinder, and a discharge line from the panel to the oil reservoir constitutes the only major piping connections. Small tubing connections are made from the relief

valve to the panel and thence back to the oil reservoir, these being for the purpose of "venting" or unloading the hydrocone type relief valve. This latter action automatically takes place between operating cycles whenever the retractable reversing cam is brought out of position and the unloading and stop cam depresses the vent valve plunger. This provides for a means of withdrawing the table to an extreme limit of travel beyond the normal reversal point and then automatically stopping the movement. The work therefore is automatically brought to a position where it can be most easily handled by the operator.

In addition to the normal advantages of hydraulic control, the arrangement shown provides for unusually complete flexibility, in that table speeds are easily adjustable, reversal acceleration and deceleration is adjustable, dwell periods at reversal (when required) are adjustable, and the stroke length can of course be changed at will by changing the position of the reversing cams.

Other standardized panel models for various reciprocating requirements, as well as panel units for all kinds of "traverse and feed" requirements, are now available. The attendant hydraulic circuit may, in each case, also be altered to obtain certain variations in operating results, thus making possible almost any desired control cycle by the proper combination of standardized hydraulic units.

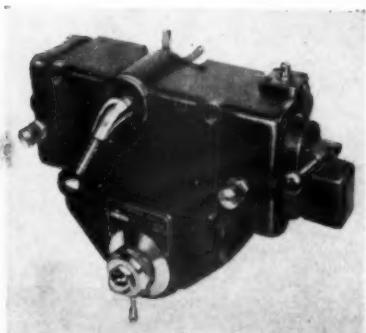
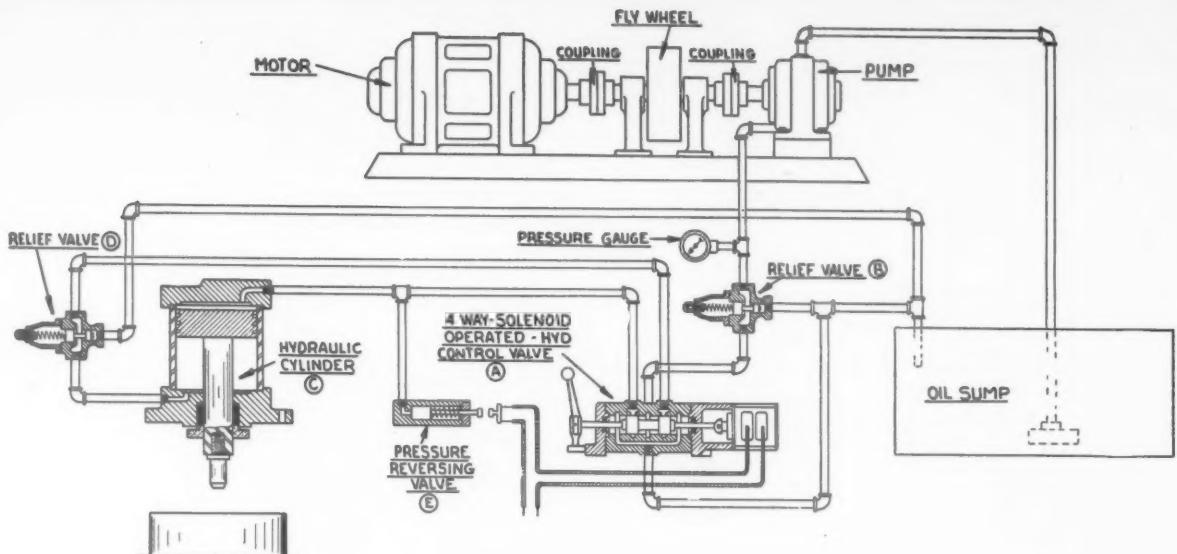


Figure 1. Vickers Model C2-1236 Hydraulic Control.



An Unusual Hydraulic Circuit

An hydraulic circuit suitable for application to machines performing riveting, staking, punching, or assembly operations.

By J. C. COTNER

CHIEF ENGINEER, LOGANSPORT MACHINE, INC.

THE principal feature of this hydraulic circuit involves the use of a flywheel on the motor pump assembly to provide the energy for momentarily building up extremely high hydraulic pressure, and thereby permitting the use of a relatively small motor for performing the work to be done. Many variations of this circuit are available, involving hand control, foot control, semi-automatic, or full automatic controls. It is possible by this arrangement to secure approximately fifty (50) ram strokes per minute, deliver momentary loads of eight (8) tons per stroke through the use of a one-half ($\frac{1}{2}$) horse power, 1,200 R.P.M. motor.

Referring to the circuit diagram, the ar-

angement of the motor, flywheel, and pump is evident and these units are mounted on a suitable base or built in as an integral part of the machine. This circuit involves a semi-automatic control where the cycle is started by a hand operated lever and the reversal of the circuit is by electrical controls through a solenoid attached to the control valve, and a pressure switch installed in the high pressure circuit. Oil is delivered from the pump to a high pressure release valve (B) which can be adjusted to the pressure required on the ram to the four-way control valve (A) which directs the flow of oil to the hydraulic cylinder (C) with the control valve positioned for directing oil to the top side of cylinder piston, the ram in cylinder C advances until it contacts the work when the high pressure of the circuit is instant-

taneously built up to a point causing the pressure valve E to operate closing the electrical circuit and causing the solenoid of the four-way valve to instantly revert to ram. Oil then flows from the valve to the lower side of the piston of the hydraulic C reversing the ram. Relief valve D is adjusted to a very low pressure sufficient for the return of the hydraulic ram, and during the stand-by period, oil from the hydraulic pump flows through this relief valve at a very reduced pressure, thereby eliminating practically any heating of the oil of the circuit.

As above mentioned, continuous operation of this circuit can be maintained and installations have been made operating up to approximately fifty (50) strokes per minute on continuous service.

By the use of this circuit, the pressures applied to the work can be adjusted, and metal parts can be riveted or staked successfully to bakelite, porcelain, and other fragile materials.

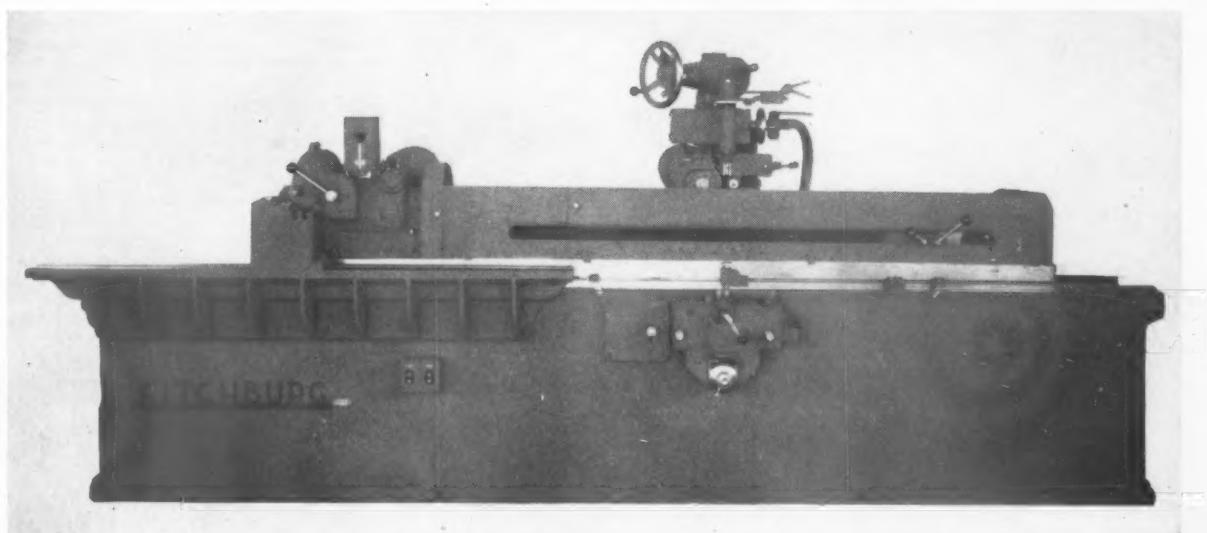


Figure 2. 60" spline shaft grinder with Vickers hydraulic control.

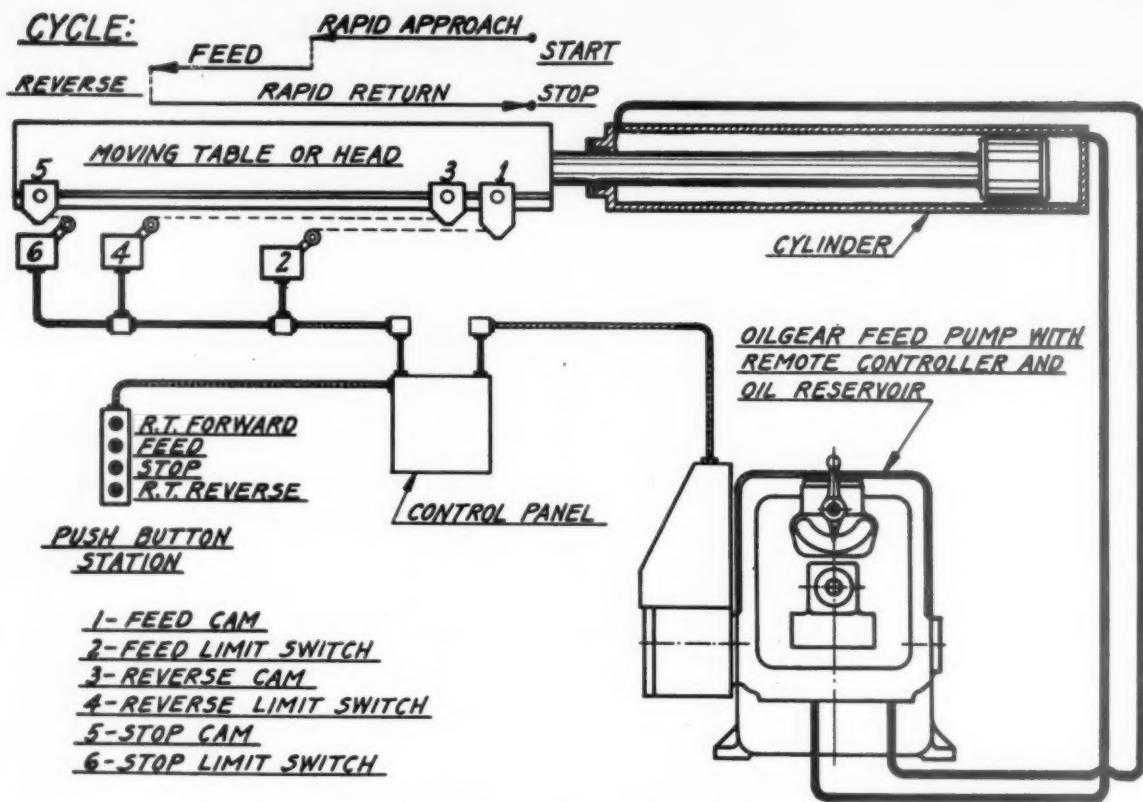


Fig. 2. Schematic Wiring and Piping Diagram for Fluid Power Feed with Remote Controller.

Fluid Power Feed Devices

MACHINE and Tool Engineers have come to recognize fluid power as an important requisite in meeting industry's demand for higher production of quality products at closer tolerances and lower costs. It has been the sole commercial solution to many linear and rotary power transmission problems. It is easy to apply and the use of high grade lubricating oil as a power fluid insures long life. Such features and advantages as higher cutting speeds, longer tool life, cushioned application of power, ability to dissipate power harmlessly, direct record of working force, protection against overload, and many others have been instrumental in the overwhelming interest and application of fluid power feeds.

In the use and application of fluid power, engineers, manufacturers and users alike are giving more consideration to the inherent characteristics of the conventional devices available. This, of course, is essential in selecting the type of device most appropriate for each application.

Commercial Feed Devices

A commercial fluid power feed unit, which has been used extensively on machine tools such as boring, drilling, reaming, milling, turning, cutting off and other machines requiring like cycles, is shown in

By M. E. ENGBRETSON
 OILGEAR COMPANY

figure one. This compact unit embodies a high pressure variable displacement feed pump, a low pressure constant displacement rapid traverse pump, a selector control valve, a high pressure relief valve, a low pressure relief valve, a back pressure relief valve, a high pressure return resistance valve and a remote controller, all of which perform important functions in the application of fluid power. Thus, the generation of high and low pressure fluid power and accurate control of same are confined into one compact unit. In appli-

cation, only two pipe lines, a cylinder and simple control mechanism are required for efficient linear power transmission.

To machines and processes employing repetitive motion sequences these highly condensed fluid power feed units provide smooth and positive adjustable feeding speeds and high rapid traverse speeds that cut the overall cycle time to a minimum. Rapid traverse volumes up to 8000 cubic inches per minute at working pressures up to 300 pounds per square inch provide high approach and return speeds. Quickly and accurately the rapid traverse movement can be changed to a pre-set feeding speed governed by the displacement of the variable feed unit. This discharge is steplessly variable from 0 to 350 cubic inches per minute at pressures up to 1000 pounds per square inch. This makes possible an exceptionally high ratio between the feed and rapid traverse speeds.

Convenient, accurate and stepless variation of the feed rate is provided by a small external control lever. Feed adjustments for tool set-up, for designs and processes not fully established or for widest variations in material, tools and production, can be made during the actual feeding operation. For repetitive cycles the feed is locked in position with a convenient lever.

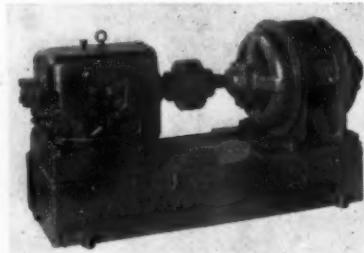


Fig. 1. Oilgear Fluid Power Feed with Remote Controller and Oil Reservoir.

(Continued on page 40)

HYDRAULIC Riveting

By O. J. MAHA

CHIEF ENGINEER

HANNIFIN MFG. COMPANY, CHICAGO.

RIVETING is one of the standard methods of joining metal plates and structural parts, and is a fundamental part of machine design. Engineers have become so accustomed to this mechanical detail, that hardly a thought has been given to the possibility of its improvement. The rivet, simplest of all fastenings, has remained unchanged since it was historically recorded. Its fundamental design consists of a round bar with a preformed head, the second head being formed after the rivet is placed in the hole of the parts to be connected. A rivet being a permanent fastening was originally designed to be peened or closed by a hammer. Later riveting machines were developed including the adaptation of hydraulic power.

Progress of Riveting

Hydraulic power has been successfully used for a great variety of purposes since its original application to the hydraulic press. It is particularly adapted to producing heavy forces with straight line or reciprocating motion working under high pressure. This characteristic was early recognized in England, and during the period from 1875 to 1900 it found useful application in the first hydraulic riveting machines. The method of distributing power was by means of water conveyed through pipes, under pressure from an artificial head, to the riveting machine. The accumulator by which this was effected consisted of a loaded plunger or ram working in a cylinder, the water being pumped into the cylinder under pressure of the load upon the ram. Maximum water pressure developed was usually 1500 lbs. per square inch. Energy thus stored in the accumulator was released as the valves at the riveting machine were opened. Hydraulic riveting proved to be much more efficient than the principal methods of transmitting power by shafting, belts or gearing during this period by the elimination of friction producing mechanisms.

However, toward the end of this period, the limitations of hydraulics were recognized. Using the accumulator as a principal source of power required the use of throttling valves, which with their inherent wire drawing characteristics caused excessive wear and consequently inefficient operation of the hydraulic riveting machines. Much difficulty was experienced with portable hydraulic riveters, as the means of conveying the water pressure to the machines in the changing positions in which they had to work had not been successfully accomplished. One other defect to be noticed was that since the greatest effort in a hydraulic riveter is required through a very small portion of the stroke, the water used during say 75% of the stroke is drawn from the accumulator, into which it has been pumped under a heavy load, simply to fill the cylinder of the machine, whereas using

low pressure water would have answered that purpose equally well. But the practical objection to this was the introduction of extra complications in valves, making the operation of the riveter dependent upon the judgment and skill of the operators.

It has always been recognized that the best hot riveting is done by machine riveters. Machine riveting causes the rivet to fill the hole more perfectly than hand riveting, and makes a closer and stronger joint. It causes the pressure on a rivet to be applied gradually over the entire rivet, and does not tend to form a shoulder as the hole is completely filled before the head is formed.

Due to the inadequacies of hydraulic power applying to small portable hydraulic riveters, compressed air was used for the operation of riveters, both compression type machines and hammers, from this period until 1934.

Compressed air operated hammers were developed and are only used today under conditions such as field riveting, or similar instances where it is not practical to use riveting machines. Rivets set with an air-operated hammer are inferior to those

set by a compression type machine. When an air-operated hammer is used to set a hot rivet, it works on the end of the rivet and usually heads it without filling the hole. In addition, another detrimental condition exists; during the process of setting a hot rivet with a hammer, the head is completely formed and yet the body of the rivet is hot; on cooling, the rivet contracts, shrinking away from the sides of the hole. Under this condition, the rivet cannot possibly fill the hole. Machine designers today nearly always use rivets in shear (although tests have been made indicating rivets may be used in tension); therefore before the hot rivet set with a hammer can take a load due to shear, it is necessary for the plates to slide a small amount. This small amount of slide, especially under reversing loads eventually causes the rivets to become loose. As can readily be seen, riveting up to this time had not been entirely satisfactory, due to lack of efficient machines for closing rivets.

Riveting Auto Frames

An advance in production riveting was
(Continued on page 42)



Fig. 1.—Hydraulic Riveting of automobile frames — method, now widely used by the automotive industry. Shown above is a 17½ ton portable riveter used to squeeze $\frac{3}{8}$ " cold rivets.

PROGRESS in Hydraulic Lubrication

By D. R. HILLIS

PRESIDENT, HYDRAULIC DEVICES, INC.

TWENTY years ago the oil can with the long spout in the hand of an oiler making his rounds was the generally utilized means for lubricating machinery. Whether some extra generous squirts dripped oil over the machine, some bearings at the top were missed, or a group of machines was passed by for the day, were determined by the disposition of the oiler, influenced by his last night's sleep and other intangible factors.

Today, with heavier cuts, with machining speeds many times faster, with the extra strain on bearings, with the complication and complexities of new equipment, it would not be practicable to even attempt to lubricate a machine by hand at each bearing. It is the writer's understanding that one of the triple action toggle presses for stamping automobile bodies would take two men four hours to properly lubricate. It might be done in a minimum of two hours. During this time the machine would have to be shut down. To try to lubricate such machinery while running would be extremely hazardous, if possible at all. With the demand for increasingly higher production such shut-downs are too expensive to be permitted.

Modern hydraulic lubricating systems applied to machinery have kept abreast of the times by providing frequent or continuous lubrication in the exact measured quantity required by each bearing, all so arranged as to be operated from one convenient central location.

Hydraulic lubricating systems are fundamentally simple in construction. What pressure is required, applied to a piston in a measuring valve, exhausts the lubricant ahead of the piston to the bearing and fills the space from which the piston has moved for the next operation.

The hydraulic systems for lubricating a number of bearings have developed during the last ten years along two major lines. In the one system the lubricant is forced from a conveniently located pump to the measuring valve located at or feeding the first bearing in the circuit. It forces the piston to the other end of the valve, and uncovers a port through which it goes on to the second valve of the circuit. The quantity of lubricant which was in front of the piston is discharged to the bearing. In this way the lubricant progresses through the loop or circuit, forcing the lubricant already in the valves to the bearings, until it reaches the end of the circuit where it moves an indicator to show that lubrication of all bearings on the machine has been completed. The next time, the lubricant is forced around the circuit in the reverse direction. It moves the pistons to the opposite ends of the valves, and forces to the bearings the lubricant with which the valves were filled at the preceding lubrication. In this system there is only one line. The measuring valves may be located conveniently on the circuit. The indicator is

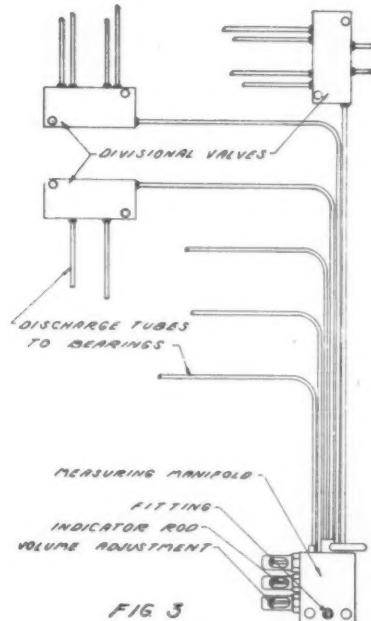
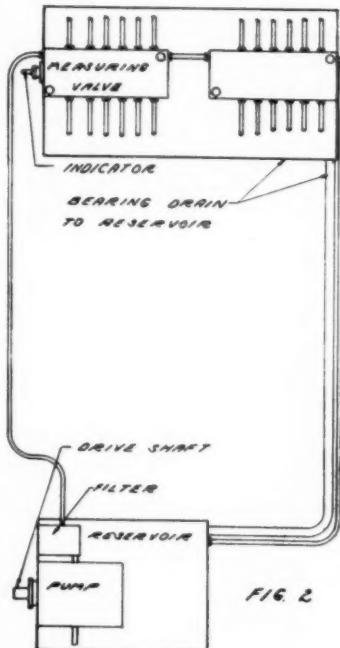
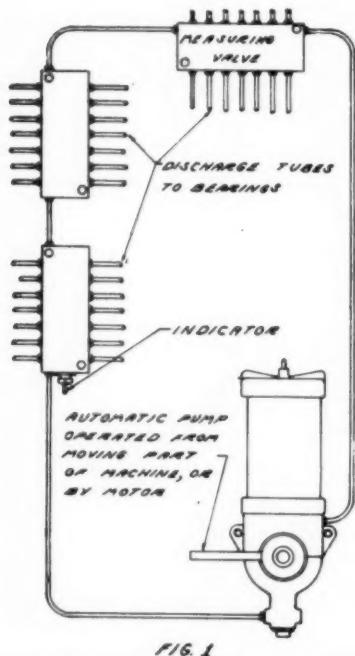
placed at the pump where it can be easily seen by the operator.

In the second system the bearings are likewise connected to measuring valves. There is a conveniently located pump, and also a flow-directing valve as in the first system. From the latter two lines are run to the measuring valves. One of the lines is connected to one end of each valve cylinder, the other line to the other end. The lubricant is pumped through one line, and moves all the pistons throughout the circuit, forcing a discharge to all the bearings. At the next time of lubrication, the flow-directing valve at the pump is opened to the other line, all of the pistons are forced back to their original positions, and the lubricant in the valve chambers is forced to the bearings.

In this system there is an indicator on the valve for each bearing. There is also a convenient outside adjustment at the indicator rod by which it is possible to adjust or vary at any time the amount of lubricant delivered to any bearing. More bearings can be lubricated with one pump.

The two mechanisms as described are manually operated systems. In other words, they have a flow-reversing or directing valve which must be shifted by hand, even though the filling and exhausting of the measuring valves is accomplished hydraulically with any pressure required. The trend in hydraulic lubrication as in all other lines has been toward fully automatic operation.

(Continued on page 34)



Production Perspectives

NEWS OF MASS MANUFACTURING FROM EVERYWHERE

MID-WEST

From East Pittsburgh, Pennsylvania, comes news that The Westinghouse Electric & Manufacturing Company has announced the early construction of new manufacturing facilities at its East Springfield, Mass., Works. The new buildings will be of latest modern design and are a part of a Westinghouse expansion program partly to take care of the large amount of business, especially air conditioning, which seems certain in connection with activities in new types of houses and partly to accommodate certain manufacturing operations which will be transferred from the Chicopee Falls, Mass., Works. It was recently announced that all radio operations at the latter Works would be transferred soon to a plant which has been acquired at Baltimore, Md. L. E. Osborne, Westinghouse Works Manager at East Springfield, reported that the new manufacturing building will have approximately 100,000 square feet of floor space. Into this new building will be moved the manufacture of water coolers and commercial refrigeration units, and space will also be provided for the manufacture of that part of the air conditioning equipment known as the room cooler type. For some of these manufacturing operations in the new building, Mr. Osborne stated that machinery will be transferred from Chicopee Falls, and from present assembly lines at the East Springfield plant. The total operation is said to involve an expenditure of \$1,250,000, a large portion of which will be expended for new machinery of the latest type capable of handling the expanded production.

The York Ice Machinery Corp. of York, Pa., has brought out a new steel cabinet unit air conditioner designed by Walter Dorwin Teague. The new portable unit has a walnut finish and rounded corners and bears somewhat of a resemblance to a radio cabinet.

Commenting on the establishment of an Australian plant for his company, The Lincoln Electric Company of Cleveland, J. F. Lincoln, President, stated, "Two generations ago a very able editor, Horace Greeley, by name, gave the following advice to a group of young men—'Go West, young man, go West!' At that time he referred to the western part of the United States. If he were living now," stated Mr. Lincoln, "He would give exactly the same advice to the same men, but instead of meaning the western United States, he would refer to Australia. Here is the land of opportunity, a country of small population, unlimited natural resources, with a people entirely imbued with the pioneer spirit and the wish to share their country with other pioneers of the white race who wish to come in. Things we do not know are that Australia has tremendous areas of the finest farm land now available, has untouched natural resources of enormous wealth and has the greatest opportunity for the young man of initiative, physical, mental and spiritual strength that can be found anywhere.

"The hare-brained experimentation which is now the rule in the United States has long since been tried, has failed and has been rejected. The lesson there has been learned. The future is assured. Individual initiative on which the welfare, standard of living and hope of the future of every country depends here is valued at its real worth. Interference with business, with initiative and with progress does not exist and the necessity for influence as a concomitant of progress is not found." While in Australia, Mr. Lincoln visited all the capital cities, giving a series of addresses before various engineering societies and groups on the developments in the art of welding. Great interest in welding was indicated by the large enthusiastic audience wherever he spoke.

About 8000 foundrymen from all points of America will gather in Cleveland May 14 to 19 for the annual convention of the American Foundrymen's Association. Foundry equipment and supplies will be on exhibit in the Mall Exhibition Hall. Harry F. Boe has been appointed manager of the service department of the Westinghouse Electric & Manufacturing Co., succeeding W. K. Dunlap, assistant to vice president, formerly in charge of the department, who retires. The combined index of new machine tool orders for March was 107, a 41 per cent increase over the February figure of 75.7, according to a compilation by the National Machine Tool Builders' Association. The domestic index was up slightly at 50.5 from 48.7 in February, an increase of 3.7 per cent. Foreign orders were doubled at 56.5 as compared to 27 in the preceding month and accounted for 52 per cent of the total against 35 per cent in February.

Close to \$100,000 was spent in April by the Eaton Manufacturing Company in rehabilitation of their Central Avenue and E. 65th. Street plant in Cleveland for the assembly of hot water automobile heaters. A major portion of the building containing 80,000 square feet will be ready for production the middle of this month according to Herbert C. Stussy, Secretary-Treasurer of the Company. This plant has been vacant for three years—it was formerly occupied by the Auto Bumper Manufacturing Division of the Company.

E. A. Hall of the Hall Manufacturing Company, Toledo, has announced a valve grinding machine which grinds all 16 valve seats in a V-type motor at one time. The sale of the first of these machines was recently made to the Ford Motor Company for a price reported to have been around \$25,000, and others are said to be under construction. A novel feature of the machine is its use of hydraulic power to manipulate the cylinder block in the machine. The Hall machine while designed some years ago, has attracted considerable attention of late since automobile and aircraft companies have begun to use valve seats of hard steel.

Carl G. Schluederberg, Vice-President and General Manager of the Ford Instrument Company, of Long Island, New York, and former head of the Westinghouse Electric & Manufacturing Company's plant in Cleveland, died April 9, at Lakeside Hospital, Cleveland, after a five-week illness.

As a result of an upturn in business in March, The Apex Electrical Manufacturing Company, added a night shift to its washing machine plant in Cleveland according to C. G. Frantz, President. He looks for another upturn in business this fall.

Cleveland Graphite Bronze Company reported through its president, Ben F. Hopkins, that sales and profit for 1937 were the highest on record.

From Dayton, Ohio, we hear that Delco-Frigidaire is marketing a new unit conditioner for cooling, filtering, drying and circulating the air in any house or office. The room may be set to any particular temperature from the control panel of this new unit.

Figures obtained from 96 steel companies representing more than 90% of the total output of the industry show that their return on investments was approximately six and three-tenths percent, the aggregate of new profits after all charges amounting to \$231,794,000, according to the figures of the American Iron and Steel Institute report of April 12th. The above figures for returns on investments compare with four and six-tenths percent return on investments in 1936.

The Associated Machine Tool Dealers of America will hold a spring meeting, Monday and Tuesday, May 23rd. and 24th, at Dearborn Inn, Dearborn, Michigan. The Association represents the machine tool dealers of the United States.

More machine tools were purchased during the last two years for expansion than for replacement. Smaller companies bought more equipment in proportion to their size and total buying both for expansion and replacement has been at the average rate of 4.8 per cent a year, according to a survey on the obsolescence of machine tools, conducted by the Warner & Swasey Co. of Cleveland. Results of the survey were announced April 14. The survey is based on replies to a questionnaire received from 251 representative concerns having an estimated 9 per cent of machine tools used in this country. Replacement purchases in the last two years constituted only 40.2 per cent of total sales of machine tools, the remainder presumably representing expansion. Replies showed that for every 100 new machines purchased 63.6 old machines were scrapped. While more machines were bought than were scrapped, approximately three old machines were scrapped for every two new machines purchased for replacement. Despite superiority of new machine tools only 4 per cent of equipment in use today, according to questionnaire returns, represent purchases within 1936 and 1937, a rate of about 2 per cent a year. Smaller companies not only bought more machines in proportion to their size, but they scrapped fewer of their old units, according to the survey. Of the machines now in use, small companies reported 14 per cent purchased in the last two years, medium-sized companies 12 per cent and larger companies 8 per cent. For every 100 machines purchased, small companies scrapped 27 machines, medium-sized companies scrap-

ped 45 and large companies 86. Firms questioned reported 67.3 per cent of present machine tools in use are over 10 years old. Since new and old machines are not comparable in capacity of productivity, the percentage of machine tools over 10 years old cannot be considered an accurate measure of obsolescence. The survey showed that two new machines replaced three old machines. Despite the fact that the percentage of machines over 10 years old may have increased, some actual progress in plant rehabilitation was definitely made. Reasons given for delayed replacement programs included criticism of taxation and inability to finance. Philip E. Bliss, president of Warner & Swasey, commenting on the questionnaire, said, "Even if all new machine tools bought in the last two years for expansion as well as replacement are to be considered in a general way to represent rehabilitation and even if due allowance is made for the increased productivity of the new machine tools, the country still has made little more than a dent in the accumulated obsolescence of its machine tool equipment."

The Chas. A. Strelinger Company, Detroit, has been appointed Michigan distributors for the V. & O. Press Company of Hudson, N. Y. The Strelinger Company will handle the entire V. & O. line including the following types of presses: Inclinable, Arch, Straight, Sided, Reducing, Notching, Double Action, Transfer, Horing and Wiring, and High Speed; also Dial Feeds, Roll Feeds and various Accessories.

Fansteel Metallurgical Corporation has appointed the Michigan Tool Company of Detroit, sales representatives for Tantaloy hard cutting metal and Tantaloy tipped tools.

EAST

Increased activity in New England industry at this time is mostly confined to interests profiting by a seasonal revival of home building and modernizing, having a special stimulant this year in the incentives provided under the Federal Housing Administration program. Such a development, as well as new home building spurred by the same influences, means more business for manufacturers, jobbers and retailers in building and allied lines.

Slight change is reported among the larger manufacturing concerns of New England. Westinghouse's East Springfield Mass., works are operating at an average of three days a week in the various departments and officials do not look for much change in the schedules in the next two months.

No increase of production has been effected at the Gilbert & Barker Manufacturing Company, West Springfield, Mass. and conditions at the United American Bosch Corporation, Springfield have developed little change for several weeks. Manufacturers of durable goods who were busy the first two months of the year on orders booked before the sharp business decline are now feeling the effect of the slump.

Production at the Van Norman Tool Company, Springfield, has eased off, but the time schedule has not been reduced.

Baldwin-Duckworth Chain Corp., of Springfield is now working a five day, 35-hour week. A company executive said that while quite a few inquiries have been coming in, there is no sign yet of a general upward trend.

Chapman Valve Manufacturing Com-

pany, Springfield, classified as a heavy-goods industry, has been keeping a full employment force steadily during the past winter because of a good backlog of orders. However, production at its plant is known to be exceeding new business.

Indian Motorcycle Corp., Springfield, recently stepped up its weekly working schedule from 35 to 40 hours. The company now employs about 400 workers, about the same number as a year ago.

Donald P. Hess has been elected president of the United American Bosch Corp., Springfield, succeeding Arthur T. Murray who resigned January 1. Mr. Hess, for the past year, was assistant to the president of the Ebcu Manufacturing Company of Columbus, O. Previously for, 17 years he was with Timken Roller Bearing Company of Canton, O. as foreign sales manager.

Governor Hurley has named the following industrial leaders to serve on the newly created Massachusetts Industrial Promotion Commission: James Y. Scott, executive vice president of Van Norman Machine & Tool Co., Springfield; Vincent P. Harran, president, Walsh Steam Boiler Works, Holyoke; W. F. Howe, president and treasurer Production Machine Co., Greenfield; Lee Sherman Cass, sales manager, James Hunter Machine Co., North Adams; Arthur H. Starrett, vice president L. S. Starrett Co., Athol; Col. Frederick H. Payne, chairman of the board of directors, Greenfield Tap and Die Corp., Greenfield and D. W. Bridgeman, treasurer of the Foster Machine Co., Westfield.

The Sesamee Company, makers of key-less locks, has been completely moved to Springfield from Hartford, Conn., and installed in its new headquarters at the Bemis & Call plant, Porter Chase, the new president of the Bemis & Call Company announces. While the business of the Sesamee Company is experiencing a quiet period, Bemis & Call has shown a pickup during the past two weeks. It has been necessary because of new orders, to call some of the men who have been laid off, back to work, he said.

Worthington Pump & Machinery Company's Holyoke works have stepped up production of portable air compressors and compressed air tools to meet seasonal demands. While such goods are being made at double the rate maintained earlier in the year, it is still far short of the normal spring peak.

About 150 men have returned to work at the H. B. Smith Company plant in Westfield, President Edwin W. Smith says. Manufacturing was halted over a month ago when the company filed a petition to reorganize under Section 77B of the Bankruptcy Act.

Porter-McLeod Machine Tool Company of Hatfield, has shipped to the Middle West the first unit of its redesigned line of Higley saws for cutting cold metals, brought to the concern last year from South Norwalk, Conn. A good field for this line is seen, both in this country and abroad. Steel warehouses and jobbing shops in the machine and tool fields are among the leading customers.

A pickup in employment and production is expected soon at the plant of the Perkins Machine and Gear Company, West Springfield.

The Boston & Albany railroad shops at West Springfield have reopened after a

week's shutdown. The shops were closed in January, but operated all of February and the larger part of March so that they are running more continuously than in some recent years.

Neils H. Roslund, 47 vice president and assistant manager of Progressive Tool and Die Co., Worcester died suddenly of a heart attack recently. More than 100 male employees of the Heald Machine Co., Worcester with more than 15 years' service with the company were guests recently of the management at a dinner at the Worcester Country Club. Frederic Snyder, lecturer and publicist, spoke.

Bridgeport, industrial barometer of Southern New England, registered another slight gain in the amount of weekly average payrolls during March, one and two-tenths per cent over February. The average was 22.49 lower than the figure for March, 1937, however. General Electric Co., largest of the city's mass production factories, was reported as slowly taking back workers, particularly in the radio department where heaviest layoffs had been made The Bullard Co., Bridgeport, having shown a substantial gain in net income for the calendar year 1937, reports orders in the first two months of 1938 lagged behind the same period of the previous year, but the backlog of unfilled orders at the year's beginning was 135 per cent greater. This factor has helped the company through the early months of the current year . . . Skinner Chuck Co., New Britain, has elected Vice-President Arthur E. Thoron, as president to succeed the late Paul K. Rogers. Paul K. Rogers, Jr., and Kenneth H. Walther have been named to the board of directors . . . Winchester Repeating Arms Co., New Haven, is making plant alterations at a cost of \$14,000 . . . Norma-Hoffman Bearings Corp., Stamford, has let contracts for two plant additions . . . A. J. Donahue, president of A. J. Donahue Corp., Milford, electric products, has been named Connecticut representative on the national advisory committee of the American Federation of Little Business . . . Hartford Special Machinery Co., Hartford, has released figures showing that it paid \$70,947 in taxes during 1937, amounting to \$451.09 for each of its 157 employees or \$14.18 for each share of stock. The taxes paid were an equivalent to 35.1 of the company's total income, which was about \$202,000. Taxes paid in 1936 equalled 29.2 per cent of total income; in 1935, 18.8 per cent, and in 1934, 14.5 per cent. The largest single item in 1937 was \$47,125 for federal income tax . . . Edward M. Pratt, 66, assistant superintendent of the Corbin Screw Corp., New Britain, and connected with the company 35 years, died March 27 . . . A. H. Meyer has formed the Naugatuck Machine & Tool Works at 1 Hard street, Naugatuck.

Armstrong Mfg. Co., Bridgeport, makers of threading tools, stocks and dies, has been given permission by U. S. District Court to reorganize under Section 77b of the Federal Bankruptcy Act in the face of a suit threatened by a noteholder. The company's petition declared it was in process of mutual reorganization, approved by a majority of noteholders, when one disclosed his intention to sue the concern for \$25,000. Such a suit, it was claimed, would force liquidation of the company, said to handle 40 per cent of the stock and die business in America.

CHAPTER DOINGS

BALTIMORE

J. J. Buckley, Publicity Chairman
5303 Elsrode Avenue, Baltimore

Mr. Howard Stagg of the Crucible Steel Company presented many interesting facts relative to the heat treatment of tool steels; together with forty-five minutes of interesting movies, covering the processing of tool steels.

The main point of his discourse centered about the importance of designing tools with a balanced section so as to avoid cracking. "Sharp angles, sharp keyways and uneven sections were devices of the devil," he said. Everyone in the audience voiced his approval, dispelling even the slightest possibility that there were any followers of Satan present. However, at the close of his talk, a group of ruddy-faced Heat Treatment men gathered about Mr. Stagg. One of them, Mr. Mitchell, who recently celebrated his fifty-first year in the Heat Treatment profession, thanked Mr. Stagg for the benefits that were sure to result from his instructive talk. So-o-o-o from that I might add that it behooves all to avoid the practices of Satan and make life easier for these Men of Steel.

On Monday May 9th, plans have been arranged for a plant tour of the Black and Decker Manufacturing Company's Plant. The invitation was extended by Mr. Fox, Plant Superintendent. Mr. Vansant, our Vice Chairman will be in charge of events for the evening.

BUFFALO

Ernest M. Dildine
Chapter Publicity Chairman

Buffalo Chapter April Meeting, was held April 11th, at King Arthur's Restaurant. The speaker of the evening was Mr. Francis D. Bowman of the Carborundum Company, who gave us a short talk on the history of Carborundum, and also showed a movie entitled "The Jewels of Industry." This was very interesting and was enjoyed very much as it was followed by a lively discussion of Grinding Wheels and Methods of Grinding.

This being our first meeting with Mr. Howard Taylor, Chapter Chairman presiding, it was a most successful meeting and we are looking forward to seeing all Tool Engineers of the Niagara Frontier at our next meeting in May.

CHICAGO

F. W. GALLANT, Publicity Chairman
Crane Company, Chicago

The regular monthly meeting of the Chicago Chapter was held on April 11 in the Machinery Club. After an informal dinner, retiring chapter chairman, F. W. Creager introduced and installed the elected officers for the ensuing year. Clifford E. Ives, of Ives Engineering Laboratories, was introduced and installed as chapter chairman. Mr. Ives had a difficult task last year as head of the Meetings committee, and made a splendid record for himself. His corps of officers for 1938 include, F. W. Gallant of Crane Co. as Vice-Chairman, R. C. Hein of Sears, Roebuck & Co. as Secretary, and Conrad Hansen of Gen'l. Electric Appliances as Treasurer. Chairman Ives proceeded to introduce the various committee chairmen who are as follows: Constitution & By Laws, E. C. Peirce, Stewart-Warner Corp;



Ray Farmer, well known A.S.T.Eer and charter member of Detroit Chapter, is shown above with his son, Bob, making adjustments on his hobby, the "Ray Special," a midget racing car Ray has designed and built. In 1936 Ray's car won the Midget Racing Car Championship of Detroit and Toledo. The little car with a specially designed 4 cylinder, 4 cycle motor develops 100 H. P. and is capable of more than 100 miles an hour. Mr. Farmer is Tool Engineer with the Cadillac Motor Car Company.

Standards, F. Bautz, Int. Harvester; Entertainment, F. Wingert, Crane Co.; Industrial Relations, J. C. Kazimier, Chicago Molded Prod.; Publicity, F. W. Gallant, Crane Co.; Nominating, R. O. Hein, Sears, Roebuck; Membership, H. D. Fruauf, Stuart Oil Co.; Meetings, Adrian Kooyman, Int. Harv.; Reception, J. G. Polhemius, Polhemius Company; Editorial, E. A. Smith, Chicago So. Co.

Mr. Ives then assumed his former role of chairman of the meeting and introduced the speaker of the evening, Mr. W. H. Oldacre of the D. A. Stuart Oil Co. Mr. Oldacre presented a very interesting talk on the applications of lubricants and cutting oils. An open period of discussion and questioning was conducted immediately following the lecture.

CLEVELAND

C. J. Hawkey, Publicity Chairman
Penton Building, Cleveland

Cleveland Chapter's April meeting was held on the 12th, in Guild Hall in the Medical Arts Building and was the first meeting under the new officers who are: P. F. Rossbach, Chairman; Andrew R. Black, Vice Chairman; Henry P. Boggis, Secretary; Charles W. Scheihing, Treasurer; Rudolph A. Fintz and P. F. Zerkle, Advisory Board. Committee Chairmen were announced as follows: Publicity, G. J. Hawkey; Membership, Charles Kotersal; Meetings, Gus Selander; Industrial Relations, O. J. Maher; Standards, Robert Beacom; Constitution and By-Laws, Alfred G. Merlin; Entertainment, Ralph H. Behrend; Recording Secretary, Ben Staskus.

The featured speaker of the evening was Mr. Trieber, Chief Engineer of Diesels from the Hercules Motor Corporation of Canton, Ohio. Mr. Trieber's talk was accompanied by stereopticon slides. Cleveland Tool Engineers learned that Diesels are not a product without a background but are a time-tried unit that is proving itself every day from the Arctic to South Africa. Much of the so-called mystery of the Diesel engine was cleared up in Mr. Trieber's talk for he showed that the principle of the Diesel first designed by Dr.

Diesel of Germany in 1894 is comparatively simple and that it has a great many strong points to recommend it for many tough jobs. Mr. Trieber illustrated a number of the various severe conditions under which the Diesel engine operates successfully and during his talk answered many interesting questions from the audience. One of the points of particular interest to Tool Engineers was that the machining of injectors for the Diesel Engine is held to a tolerance of three millionths of an inch. In closing Mr. Trieber made an excellent suggestion for those who operate gas engines to do as the Diesel operator does—namely to use a Viscosimeter which is connected in the lubricating line to show how heavy the oil is and also how thin it may be. He stated that it was a warning not to race a motor while the oil is cold and thick which results in the oil not getting to the vital parts quick enough from a cold start thus causing scoring, and when the oil is thin it is a warning that the oil has lost its body and should be changed. If the operator of a vehicle, whether gas or Diesel powered, would follow the dictates of this instrument, many thousands of miles would be added to the life of his engine, and he also stated that more damage is done on a cold start than under eleven hundred miles of actual running conditions.

DETROIT

James F. Gilliam, Publicity Chairman

The main object of the April 14th meeting of Detroit Chapter was the installation of the newly elected chapter officers who are: Chairman, F. W. Eaton; Vice-Chairman, C. Thiede; Secretary, R. M. Smith; Treasurer, George Demorest. The oath of office was administered by Ford R. Lamb, National Executive Secretary. The "Vice-Chairman" is a newly created officer whose duties will be to act as an understudy for the chairman and to shoulder some of the duties of supervising various committee chairmen. The following committee chairmen were introduced by Mr. Eaton: Meetings, Ken Kuhn; Industrial Relations, L. W. Howe; Membership, A. Ketelsen; Reception and Entertainment, C. L. Hause; Publicity, J. F. Gilliam; Standards, J. P. De Montigny; Constitution and By Laws, J. A. Marks-trum.

Three talks were given. Mr. F. W. Eaton gave a short talk on the general outline of "Apprentice Training." Mr. Lovenston talked on the making of gages. Ken Kuhn discussed modern industrial relations problems. F. C. Hebert gave a short talk concerning the service a purchaser can expect from the equipment manufacturers.

After the talks a short motion picture entitled "Wheels Across Africa" was shown.

MILWAUKEE

Emmor E. Houston, Chapter Publicity Chairman

1029 South 35th Street, Milwaukee

With the April meeting, about 160 members attending, Milwaukee Chapter resumed its regular schedule of meetings following the Detroit show. The following newly elected officers presided at this meeting: Eldred Rutzen, Chairman; Harold Heywood, Associate Chairman; Julius Riedel, Secretary; and Sidney Hall, Treasurer.

A. H. d'Archambal, former chairman of the Bridgeport Connecticut Chapter, was the guest speaker. Mr. d'Archambal's paper on gauging and gauging methods was highly enlightening to our members. (Continued on page 24)

MAY CHAPTER MEETINGS

Chapter Meeting Announcements must be received on or before the 15th of preceding month to appear on this page. Members and friends of The Society contact Chapter Secretaries for meeting details if your announcement does not appear below.

BALTIMORE

May 9, 1938—8:00 P.M. Black and Decker Manufacturing Company, East Penna Avenue, Towson, Md.

Plant visitation will be conducted by Mr. Fox, Plant Superintendent and Mr. VanSant, Chapter Vice-Chairman. For information, call Hamilton 0851 J.

BUFFALO

May 9, 1938—For reservations call or write W. F. Weinreich, Un. 9044, 649 Minnesota Avenue.

CHICAGO

May 9, 1938—Dinner at 6:45 P.M. Technical Session at 8 P.M. Machinery Club, 571 Washington Blvd.

Speaker: Mr. C. A. Birkebak of Ex-Cell-O Corp. **Mr. Ford R. Lamb, National Executive Secretary,** will also be a speaker at this meeting.

Subject: "Precision Boring and Facing Machines."

Reservation: \$1.25 per plate—mail reservations to Chapter Secretary Robert O. Hein, 2243 Lincoln Ave., or call Diversey 1475.

CLEVELAND

May 10, 1938—Dinner at 6:30 P.M. at Guild Hall, Prospect opposite Higbee Store. Technical Session, 8:00 P.M.

Speaker: Francis D. Bowman, Advertising Manager, Carborundum Company, Niagara Falls, New York.

Subject: "Story of Abrasives, Their History and Uses," with motion pictures.

Reservations: Notify Henry P. Boggis, Endicott 3611 if you expect to attend. Do it early.

DETROIT

May 12, 1938—Dinner at Ford Trade School Cafeteria, 6:30 P.M. (will not exceed \$1.00 per plate) Members and guests will meet at the Ford Motor Co. Rotunda at 6:30.

Speaker: One of the Ford Executives.

Inspection trip through the Henry Ford Trade School and the Ford Motor Company's glass manufacturing Plant.

Reservations: Be sure to phone A.S.T.E. Headquarters, MA. 7960.

HARTFORD

Hartford Chapter plans no regular meeting for May but will have an Outing about May 16th. at one of the nearby country clubs, with outdoor sports, contests, dinner, etc. Plans are not complete and definite date has not been set, but will be announced at the next meeting.

MILWAUKEE

May 12, 1938—Dinner at 6:30 P.M., Republican House.

Speaker: Edward Bachmer, of Chicago, Ill.

Subject: "Phenol Formaldehyde Materials."

Talking pictures will also be presented on the subject of "Molds and Molding."

MINNEAPOLIS — ST. PAUL (TWIN CITY CHAPTER)

May 18, 1938—Union Cafeteria of the University of Minnesota.

Speaker: Mr. George M. Class of the Gisholt Machine Co.
Subject: "Automatic and Turret Lathe Tooling."

NEW YORK — NEW JERSEY

May 10, 1938—Dinner at 6:30 P.M., Robert Treat Hotel, Newark, N. J. Meeting at 8:00 P.M.

Speaker: E. V. Crane, Staff Engineer, the E. W. Bliss Co.
Subject: "Die Design and Use in Metal-Working Presses."
Reservations: Call Ben Brosheer, Medallion 3-0700.

PHILADELPHIA

May 17, 1938—6:45 P.M., Cadillac Tavern, 4228 N. Broad Street, Philadelphia. Get acquainted meeting, dinner and floor show.

PITTSBURGH

May 13, 1938—Dinner, 6:30 P.M., Fillet Mignon \$1.10 at McCann's Dining Room, Diamond Street, Pittsburgh. Technical Session 8:00 P.M.

Speaker: R. F. Helmkamp, Air Reduction Sales Company.
Subject: "Management of Machine Cutting Operations with Gas."

Reservations: Please make dinner reservations before noon, Friday, May 13. Call Miss Wingard, Brandywine 1500, Extension 9378.

Parking: Special rate for parking in McCann's Garage, same building. Have parking coupon stamped by cashier.

RACINE

May 16, 1938—Dinner at 6:30 P.M., Technical Session at 7:30 P.M. Meadowbrook Country Club.

Speaker: Mr. Edward F. Bachner, General Manager of Chicago Molded Products Corporation, Chicago.

Subject: "Molds and Molding."

Sound Moving Picture on manufacture of Bakelite. Display of Molds and Molded Products.

ROCHESTER

May 10, 1938—Dinner at 6:30 P.M., Culver Arms 1070 University Avenue, \$1.00. Technical Session 8:00 P.M.

Speaker: From Standard Oil Co., also film.

Subject: "Lubricants and Coolants."

TOLEDO

May 24, 1938—Dinner at 6:30 P.M., \$1.00 per plate at The Toledo Yacht Club. Technical Session at 8:00 P.M.

Speaker: Mr. William A. Hart, Chief Engineer, The Colonial Broach Company, Detroit.

Subject: "Broaching and Broaching Machines". Mr. Hart's lecture is illustrated with slides and depicts the history of broaching from the original principle to the present day, then goes into broaching applications, showing the job to be broached and the methods of tooling the job for broaching.

Announcing

A NEW POPULAR PRICED STARRETT INDICATOR

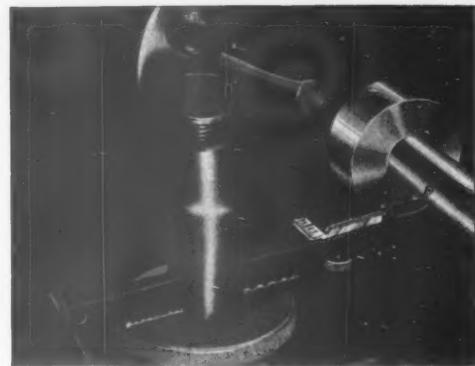
"Universal Junior" No. 564

Here is an indicator that is sensitive, accurate, flexible and adaptable to practically every conceivable indicating operation. It is made to Starrett standards of precision and workmanship *and sells for only five dollars.*

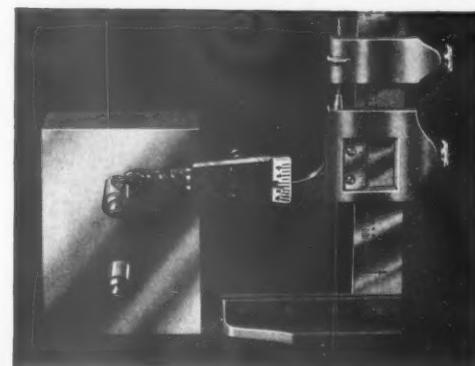
Ask your regular distributor to demonstrate this new Starrett Indicator or write for "Universal Junior" Folder T.



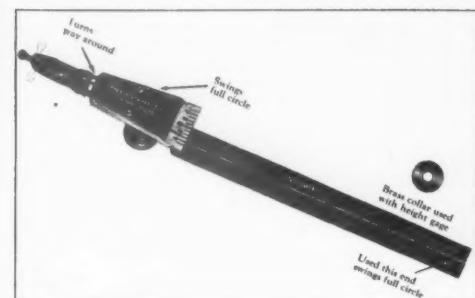
COMPLETE FLEXIBILITY is shown by indicator mounted in lathe tool post. Point which is frictionally held in rotating sleeve can contact work at any angle.



GRADUATED SCALE, with a range of .012 by thousandths, can be set in preferred position by mounting indicator on side or top of shank.



ADAPTABILITY illustrated by indicator removed from shank and clamped to jaw of height gage.



ACCURACY is assured by simple design and careful workmanship. Indicator is $2\frac{1}{2}$ inches long, shank 5 inches. Case-hardened steel and die-cast parts.

THE L. S. STARRETT CO., ATHOL, MASS., U. S. A.

World's Greatest Toolmakers — Manufacturers of Hacksaws Unexcelled — Steel Tapes, Standard for Accuracy — Dial Indicators for Every Requirement

Standardize on

BUY THROUGH YOUR DISTRIBUTOR

CHAPTER DOINGS

(Continued from page 21)

although gauging practice has been considered almost common place in the production fields. The Tool Engineer cannot help but realize that production products such as automobiles, farm machinery, radio, etc., are made possible only through accurate gauging methods.

The meetings committee have long realized the necessity of having the members of the Chapter take part in planning meetings and have, therefore, prepared a questionnaire asking our members what subjects they wished discussed during the coming year. The committee will then plan for the forthcoming season by having papers prepared and presented on the ten highest subjects chosen.

Recent changes in personnel in Allis-Chalmers Tractor Division are: A. J. Tank, Superintendent of Maintenance, Tool Engineering and Tool Rooms; E. E. Houston, Maintenance Supervisor; J. De Windt, Chief Engineer of Tool Design; and Frank Mueller, Tool Room Foreman.

MINNEAPOLIS-ST. PAUL

P. A. Clark, Publicity Chairman
5513 13th Ave. South, Minneapolis,
Minnesota

The regular monthly meeting and installation of officers of the Twin City Chapter was held at the Minnesota Union, University of Minnesota, Wednesday evening, March 16th. Fifty-five members attended. The officers installed are: Geo. S. Wise—Chairman, Eugene F. Huot—Vice Chairman, C. V. Bakule—Treasurer, M. H.

Potter—Secretary. Mr. Wise, after conducting the business incidental to his new office, touched on his trip to the Convention. His description of the enthusiasm he met with among the members of the board of directors was received with great interest. The speaker of the evening was Mr. Chas. E. Adams of the Twin City Die Casting Co. His discussion covered the metals, methods, machines and dies employed in the making of die castings. He traced the history of the art from its origin, up to the present time, and included his views on future developments. It was his opinion that we would soon see a marked increase in the use of brass as a die casting metal. Following his talk, he answered a number of questions after which he invited the members to inspect several dies he had brought for that purpose. Mr. Adams was given a standing round of applause in appreciation of his efforts.

NEW YORK-NEW JERSEY

G. J. Oliver, Publicity Chairman
239 W. 39th Street, New York, N. Y.

An air travel film and a talk by an airlines pilot capped a splendid technical program at the April 12 meeting of the New York-New Jersey Chapter at the Hotel Robert Treat, Newark, N. J. Earlier in the evening an absorbing talking picture was also shown covering the manufacture of all types of wire and flat springs in the plant of the Wallace Barnes Co. of Bristol, Conn; followed by a paper on springs presented by Ernest L. Goff, superintendent of the spiral division of that company. Several hundred members and guests were in attendance.

In pointing out some of the progress made in the manufacture of spring steels, Mr. Goff indicated that with suitable heat treatment, high carbon steels can be raised to a tensile strength of 400,000 lbs. per sq. in., with a safe load carrying stress of 300,000 lbs. Many clock spring are stressed between 250,000 and 350,000 lbs. in the original winding. These high strengths are as a result of cold working by many rollings and by annealing. Incidentally, in the manufacture of 1000 clock springs, over two miles of stock will be used, and the breakage in winding is less than 1 per cent.

Up to its elastic limit, soft steel will carry as much load as hardened steel, Mr. Goff pointed out, and the only purpose of the heat treatment is to raise the elastic limit so that the spring will perform at higher unit loads. Its deformation per unit of load will not vary however, contrary to popular belief. Stiffness is a measure of the deflection and is given by Young's modulus, which is merely unit stress divided by unit deformation. All steels have the same modulus, regardless of heat treatment, but other materials vary quite widely.

Mr. Goff then analyzed some of the factors relating to tolerance, indicating some of the difficulties in manufacture, and what effect slight changes in dimensions had on load carrying capacity and deflection. Common tolerances on a valve spring would be 0.001 in. on wire diameter, 0.010 in. on spring diameter and 1/7 of a loop on coils. For high stress springs, Mr. Goff recommended the use of the Wahl formulas, which relate mean diameter to wire diameter.

PITTSBURGH

J. H. Thomas, Chapter Publicity Chairman
7442 Pennfield Court, Pittsburgh
Mr. Edward Griffiths, Director of Time
Continued on page 32

PRECISION PAYS



DANLY DIE SETS AND
DIE MAKERS' SUPPLIES
From the 8 Danly Branch
Office Stocks

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990 E. MONUMENT AVENUE
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It's a matter of sound good judgment to specify Danly Precision Die Sets for your dies. Guide posts are hardened, ground and *lapped* to $\pm 1/10,000$ of an inch. You get maximum protection from production line tie-ups due to shearing, and consequent need for repair and regrinding of the die, if not destruction of the die itself.

PRECISION PAYS—DIE SETS ARE PRECISION TOOLS

Get production line insurance by specifying
Danly Die Sets.

DANLY MACHINE SPECIALTIES, Inc., 2114 So. 52nd Ave., Chicago, Ill.

DANLY PRECISION DIE SETS

Redesigned and Modernized to meet MODERN CONDITIONS!

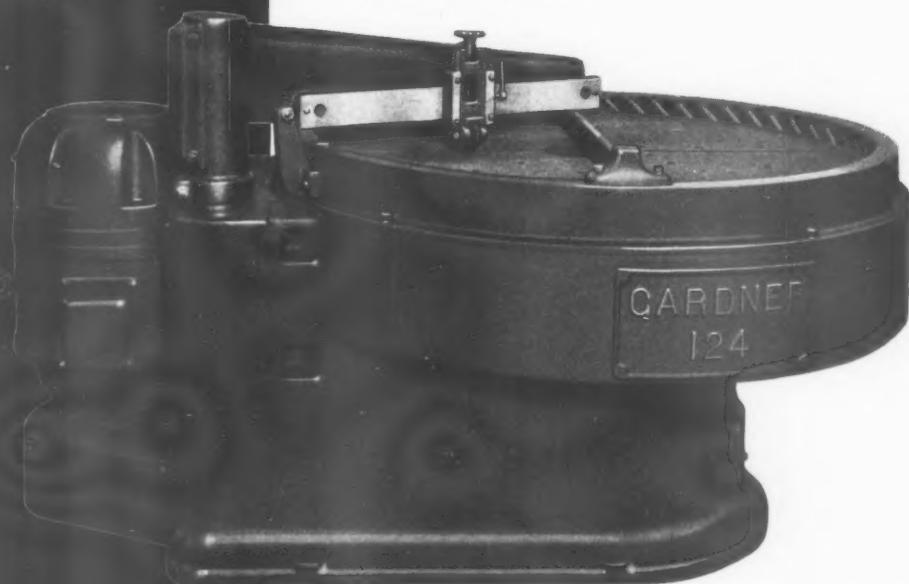
The NEW GARDNER No. 124-53" HORIZONTAL DISC GRINDER

TO MEET the requirements of those who prefer V-belt motor-driven equipment, and who favor the use of standard motors, this new Gardner No. 124-53" Horizontal Disc Grinder has been designed.

It is of larger dimensions and greater weight than older models, and it embodies several important features found in no other machine of this type. Briefly, they are:

- A new, louvre-type REMOVABLE guard ring, with louvres cast at the scientifically proper angle for quick removal of dust.
- A swinging BAR-TYPE dresser, providing maximum rigidity, and insuring ideal dressing, to be accomplished AT ANY TIME.
- Top of guard ring nearer floor than customary, thus reducing manual effort in lifting work on, or off, the grinding member.

Ideal for the quick generating of a good, flat surface on an almost unlimited number of jobs, this new model Gardner Horizontal Grinder provides the added advantages of fully-modern, 1938 design and construction.



Write for
details!

GARDNER MACHINE COMPANY

442 East Gardner Street Beloit, Wisconsin, U. S. A.

"Constant Volume", "Two Pressure" and "Variable Volume" Pumps Meet Every Oil Hydraulic Requirement

ONE decision to be made when working out each oil hydraulic control application concerns the type of pump that should be used. There are two general types or classifications of pumps that may be contemplated. The first is known as the constant volume or constant delivery type, while the second is termed a variable volume or variable delivery type. Both classifications are represented by the well-known Vickers standardized products shown sectionally on this page.

Fig. 1 illustrates the internal construction of the constant delivery Vickers Balanced Vane Pump. A minimum of moving parts, each held to close interchangeable manufacturing limits, and a patented pressure balance principle of operation, which eliminates bearing loads during operation, make this a very economical pump from the standpoint of both first cost and upkeep. In addition to the low cost advantage, these constant delivery type pumps are extremely quiet in operation, can operate without any difficulty whatsoever at pressures as high as 1000 lbs. per sq. in. continuously if called upon to do so, are compact, self-compensating for wear, and

have extremely high efficiency ratings. They provide an ideal hydraulic power source for the largest percentage of installations.

Certain installations requiring great variation of volume during a working cycle are able to obtain the advantages of the constant delivery type pump without appreciable sacrifice of efficiency by using what is known as a "two pressure" system. This method uses two constant delivery type pumps (either separately mounted or integrally designed into a single housing) in such a manner that large volume from both pumps is automatically provided at the lower pressure, and smaller volume from but one of the pumps at the higher pressure. This prevents so-called by-passing of oil in undesirably large quantities on those installations where such a condition would otherwise exist if a single constant delivery pump were used. Unnecessary heating of the oil may therefore be eliminated, while constant delivery pumps may still be used. Fig. 2 shows a typical Vickers design which accomplishes this result, and uses two balanced vane constant volume type pumps having the same

operating advantages as the single Vickers Balanced Vane Pumps.

On certain installations a variable volume pump is desirable to the extent that the somewhat higher cost is justified. For these jobs Vickers' Application Engineers recommend the Vickers Multiple Piston Variable Delivery Pumps, shown sectionally in Fig. 3. These pumps are made manually or automatically adjustable so that they deliver the exact volume required during all parts of the machine or press cycle. They have a number of exclusive design features that recommend them highly for heavy duty installations.

Each of the three types of pumps: the constant volume, the two-pressure, and the variable volume, are manufactured by Vickers, Inc., 1416 Oakman Blvd., Detroit, Mich. There are a great many sizes and mechanical modifications available in each type to meet every conceivable oil hydraulic pumping requirement. This line of pumps, together with a comprehensive line of hydraulic control valves, make it possible for Vickers to engineer complete installations for all branches of industry.

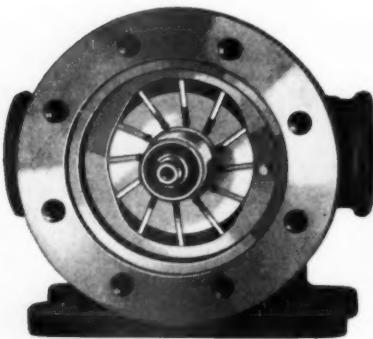


Figure 1.

"CONSTANT VOLUME"

Internal Construction of Constant Volume Vickers Balanced Vane Type Pump.



Figure 2.

"TWO PRESSURE"

Vickers Combination Pump Assembly, using two constant volume pumps to give variable volume effect.

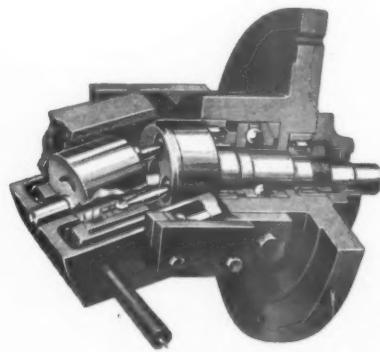
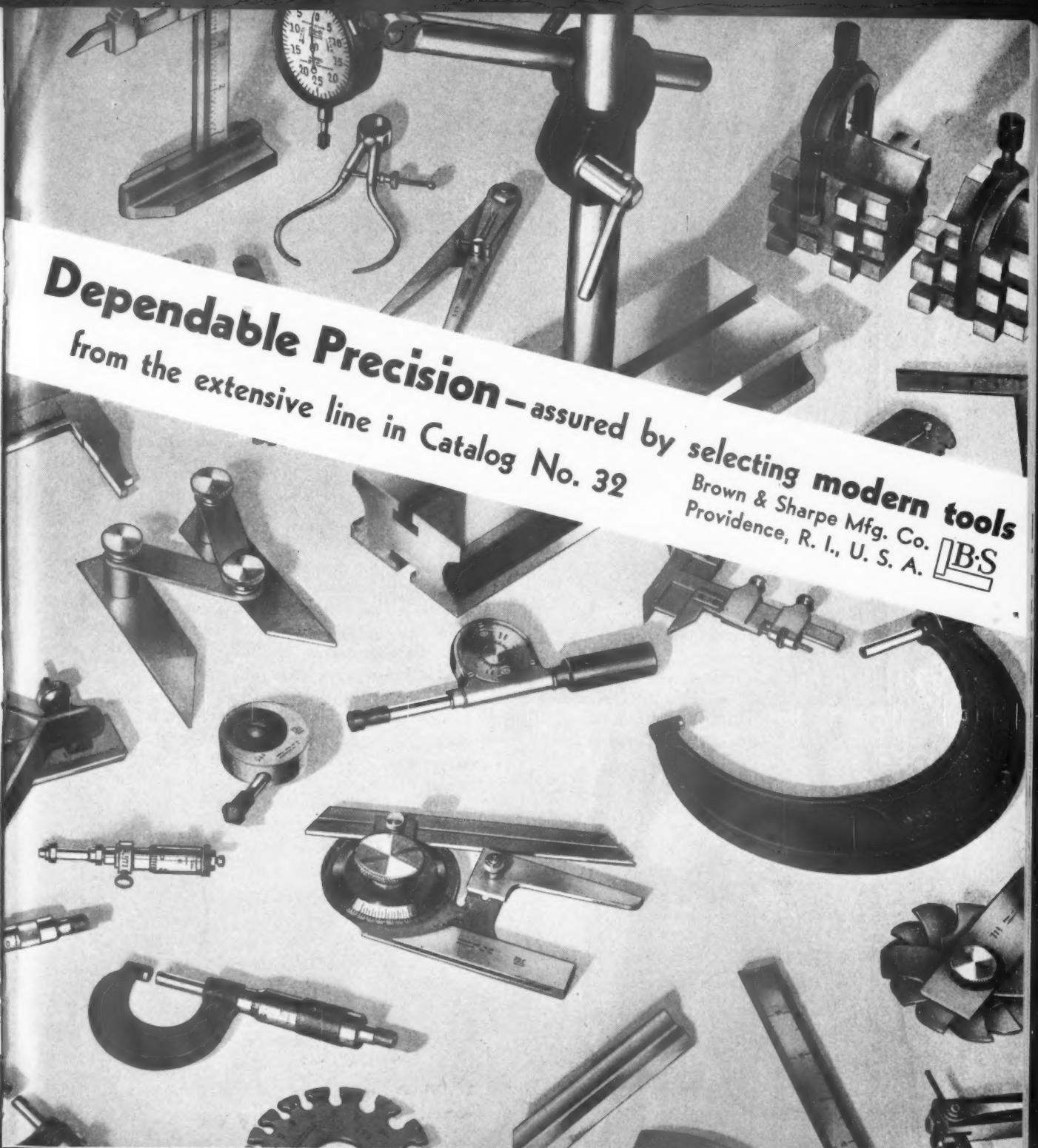


Figure 3.

"VARIABLE VOLUME"

Sectional View of Variable Volume Vickers Multiple Piston Type Pump, which may also be used as a Fluid Motor.



ecting modern tools
Brown & Sharpe Mfg. Co. [B-S]
Providence, R. I., U. S. A.

BROWN & SHARPE TOOLS

END DIE TROUBLES

WITH STRENES METAL

For years, tool engineers have been looking for an alloy with the characteristics of Strenes metal . . . an alloy low in cost . . . long in life . . . and requiring little attention.

WHY STRENES METAL MEETS YOUR REQUIREMENTS

Dies of Strenes metal are 30% to 50% less expensive. Not only is the metal itself less costly, but casting it to shape (to surprisingly accurate limits) gives additional savings. Strenes dies virtually eliminate the need for Kellering, machine finishing and the use of steel inserts.

Strenes dies require 1/3 to 1/6 less stoning and polishing (taken from actual case records) because they don't gaul . . . don't pick-up. And due to the deflection factor of .23, they don't break.

Long life is another Strenes metal characteristic. A typical example is a refrigerator top die which produced 850,000 stampings out of .050 material and still remained in excellent condition. Strenes dies produce few imperfect stampings because of the unexcelled graphic surface lubrication (very noticeable on difficult draws.)

STRENES METAL IS A SECRET ALLOY

Strenes metal is a chrome, nickel, molybdenum alloy with a high steel base. The formula is secret and closely guarded. The analysis varies slightly with different jobs, but in all cases it is definitely predetermined. To make sure that Strenes metal is always uniform, always capable of giving finest results, we keep a close watch over every melt. *Strenes metal is licensed to no other foundry.*

WIDELY USED

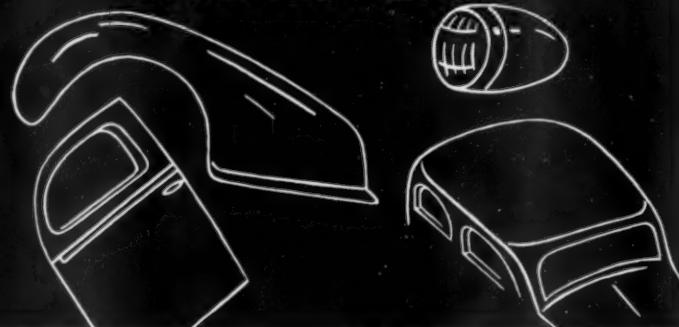
Strenes metal is not an untried alloy. To the contrary, it has been adopted for various uses by *one-half* the automotive companies. Farm implement, stove, and refrigerator manufacturers are also extensive users. All report record-breaking performances.

Cast-to-shape Strenes metal is a natural for your forming and drawing dies. We urge you to send for the descriptive bulletin which we will send without charge or obligation on your part. The Advance Foundry Company, Dayton, Ohio.



Representatives: W. R. McDonough & Co., National Bldg., Cleveland, Ohio • F. W. Peterson, 7310 Woodward Ave., Detroit, Michigan
Fred H. McGee, 917 Carter St., Chattanooga, Tennessee • Gilbert T. Osborne, 6037 Park Ave., Indianapolis, Ind.

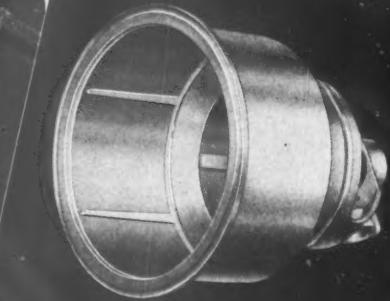
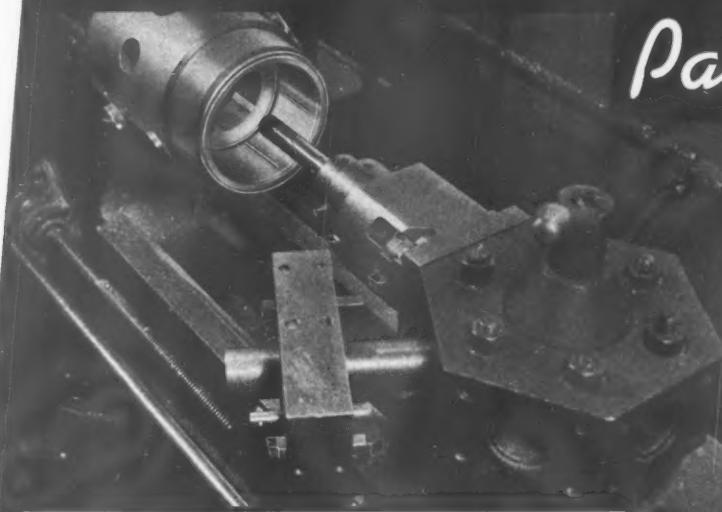
ONE HALF THE AUTOMOTIVE COMPANIES USE STRENES METAL



For radiator shell dies, for door dies, for fender dies, for all-metal top dies, for instrument panel dies, for headlight dies. One company in this typical field for Strenes metal now has sixteen die sets of this alloy in operation.

**SEND FOR FREE
DESCRIPTIVE BULLETIN**

In 18 HOURS this CARBOLOY tool set-up Paid for itself!



Five tool Carboloy "set-up" for machining silicon-aluminum motor housings of REXAIR HOME CONDITIONER. Operations: Bore two diameters (intermittent cut), face and form radius. Tolerance on field diameter: .0015".

These five Carboloy tools, costing \$40.14, paid for themselves in the first 18 hours of production! They're in the clear now and still going strong!

Every 63 minutes they pay a 6% dividend on the original investment cost! To date (after 31 days operation) they have yielded a \$572.00 saving . . . *before the first re-sharpening!*

An unusual case? No! . . . The "pay out" period for Carboloy tools is measured in days and hours. A complete return in one day or less is common.

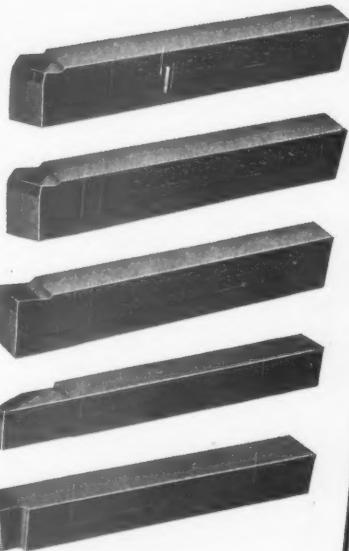
When you can make such savings *so rapidly*, WHY WAIT to tool up with Carboloy? You need these savings *NOW* more than ever before!

CARBOLOY COMPANY, INC. DETROIT, MICHIGAN

CHICAGO • CLEVELAND • NEWARK • PHILADELPHIA • PITTSBURGH
STAMFORD, CONN. • WORCESTER, MASS.

Canadian Distributor:
Canadian General Electric Company, Ltd., Toronto

Before the first re-sharpening . . .
These tools have yielded a \$572.00
return on a \$40.00 investment cost.



With Such Savings...So Rapidly
Why wait to Tool-up with Carboloy?

Carboloy Co., Inc., 2983 E. Jefferson, Detroit
How fast will Carboloy tools "pay out" on the
following job?

Name _____

Company _____

City _____ State _____

CARBOLOY

REG. U. S. PAT. OFF.
CEMENTED CARBIDE TOOLS

Mention "The Tool Engineer" to advertisers

THE TOOL ENGINEER FOR MAY, 1938

ALL J&L Automatic



JONES & LAMSON MACHINE

Thread Grinders have these

BUILT-IN truing features

AUTOMATIC WHEEL TRUING The wheel is automatically trued to the correct shape at any time pre-determined by the operator. Because of this feature, and the automatic sizing, roughing and finishing cuts are combined.

AUTOMATIC SIZING The machine automatically feeds to depth, the amount of feed at each pass being pre-determined by the operator. The machine stops when size is reached.

BACKLASH COMPENSATOR Grinding may be done in one direction, with a rapid traverse return stroke, or in both directions by using the backlash compensator.

THREAD MATCHING DEVICE Threads which have been roughed at a previous operation are easily matched on the machine. For work in large quantities a bench device is supplied. This allows the operator to match the threads and adjust the dog on a second piece of work while the first is being ground.

WIDE RANGE Pitches from 2 to 48 inclusive (33 pitches), both RIGHT and LEFT hand, with standard change gears.

Diameters up to 8" using a 20" wheel—up to 11½" using a 16½" wheel.

Lengths, up to 18" on any part of work 36" in length.

Maximum work length, 48" between centers.

Longer shafts, up to 15/8" diameter, may be inserted in the hollow headstock spindle and held in a chuck or collet.

MULTIPLE THREADS Threads with 1, 2, 3, 4 or 6 starts, either right or left hand, can be ground with standard equipment.

PROVISION FOR TAPER WORK Taper threads can be ground at any time on the standard J&L Thread Grinder by the addition of a simple former. No compensation for lead is necessary.

STANDARD ATTACHMENTS In addition to the above features, standard attachments can be supplied for grinding relief or fluted taps and hobs, for grinding annular grooves on hobs and chasers without lead, and for grinding internal threads.

COMPANY, Springfield, Vermont, U. S. A.

CHAPTER DOINGS

(Continued from page 24)

Study and Methods, Westinghouse Electric & Mfg. Co. addressed the Pittsburgh Chapter for their April meeting on "Tool Steel." His talk covered the following points on tool steel: Purchasing, inspection of raw material, inventory of sizes, short end's store room, the duties of Tool Supervisors and Tool Designers, Application of Steel, fabrication, heat treatments, manufacturing operations on tool steel and tools in use in the factory. A number of questions from the members, mostly on heat treatments of steel were answered by Mr. Griffiths.

Mr. J. R. Weaver reported on the "Machine Tool and Progress Show" and an-

nounced the semi-annual meeting for October. It was suggested we try to bring the meeting to Pittsburgh. Mr. A. F. Murray had his trained mouse for a travelling companion on the train to Detroit. Bill Vecker, R. W. Mallick and Johnny Sckerka missed the hot spots on Diamond Street. Too bad the meeting did not close sooner. Malcolm F. Judkins our treasurer said he had nothing to report but "We still have lots of money in the bank." Mr. J. P. Wiley our new V. Chairman had his seat at the speakers table. Said Chairman Grace, "I am going to put my assistants to work." So we will look for a speech next time J. P. E. L. Lundstedt is our new Chairman of "The Standards Committee." Keep our standards high, Ed. Bill Owens is now on the "Program Committee." He is from Pittsburgh Plate Glass Co. You

know "people who live in glass houses shouldn't take a bath in the day time." We are glad to receive the application for membership of W. B. Peirce, Works Manager of Flannery Bolt Co. D. A. Shaw must be doing some missionary work. Mr. L. D. Bards of the Publicity Comm. will have charge of newspaper publicity from now on. So, if you want to get your "pitcher" in the paper see him. Ask Phil Henninger where he got those cigars at the last meeting. I think he has something there.

ROCHESTER

C. G. Newton, Publicity Chairman

At the Sagamore Hotel Tuesday, April twelfth, the Rochester Chapter with Mr. John Bartech presiding, listened to Francis D. Bowman, Carborundum company, give a talk entitled, "Story of Abrasives."

The many ramifications of grinding wheel applications from the toughest tool steel grinding as one extreme to the grinding of whale blubber on the other, opened the eyes of most of the Society listeners as it demonstrated the wide diversity of grinding applications, that the various manufacturers of these materials must meet. Mr. Bowman's talk plus the film he showed indicated the vast research which has accompanied the forty-seven years since Edward G. Acheson discovered the carborundum process in Monongahela, Pennsylvania. In his opening remarks, the speaker disclosed the fact that Mr. Acheson had done considerable work with Thomas Edison by supplying him with carbon electric lamp filaments.

The talk reminded the audience that modern mechanical accomplishments rely to a great extent on abrasive manufacture for much of the fine finish as well as accurate dimensional control.

ROCKFORD

Jess Early, Publicity Chairman
823 Brooke Road, Rockford, Ill.

282 Tool Engineers and their guests swarmed into the factory of the Sundstrand Machine Tool Co. when Rockford, Chapter held its monthly meeting. The guests and members began to arrive at 3:30 P.M. for the shop visitation and from then until 6:00 P.M. were conducted through the factory in groups by officers of the company. The visitors seemed eager to hear every word of explanation offered by the guides of the various groups and there were no end of questions regarding the limits, possibilities, sizes, etc. of the machines on display.

A large number of the machines that make up Sundstrand's line of products were assembled together on the main floor of the new addition to the factory. Each machine was in charge of a skilled operator and as the group of visitors stopped to inspect each exhibit, the machine was put through its full cycle of operation while the guides explained its capabilities. At 6:00 P.M., the dinner-bell chimed its welcome carol inviting all to a very tasty "Smorgasbord." By the time the dinner was finished the attendance had grown to approximately 375, which established a new record of attendance for our Chapter and filled to capacity the large space set aside for the meeting.

Immediately following the dinner, Mr. H. Ruehl co-chairman, opened the meeting by introducing a number of officers and engineers of the Sundstrand Machine Tool Co. and officers of the local chapter. Mr. Gust Ekstrom, Vice Pres. and Gen. Manager of the company gave an address

(Continued on page 34)

1. Stronger Teeth
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CHAPTER DOINGS

(Continued from page 32)

of welcome to the visitors and expressed his surprise at the number present. Next came a short talk on the Machine and Tool Progress Exhibition at Detroit by Herb Olson in which those who were unable to go to Detroit were given some of the outstanding figures regarding the smashing success of that great event.

Mr. Swenson of Sundstrand Machine Tool Company gave a very descriptive and interesting lecture on the inside workings of Sundstrand pumps. His talk was amplified by the use of charts and interspersed with invited questions from his audience.

Rockford Chapter No. 12 wishes to express thru the Tool Engineer its deepest sympathy to Mr. E. W. Dickett, its Chair-

man, in the recent passing of his wife. We of Chapter 12 know that Mr. Dickett's many friends will be grieved to learn of his great loss and will join us in our feeling of sympathy for him.

HYDRAULIC LUBRICATION

(Continued from page 18)

ation, made necessary in this case by the frequent application of lubricant required. This trend necessitated on these first two developments an automatic pump either driven by a motor or the machine itself, a somewhat complicated flow-reversing or directing mechanism, and in some cases electrical timing devices to control the frequency of delivery. Automatic operation of the above mentioned systems gives satisfactory results on large equipment where a minute quantity of lubricant to each

bearing is not required, such as steel mill equipment, presses, etc. On account of the difficulty of regulating to a fine discharge these systems are impracticable for certain other types of equipment.

The latest development in a centralized hydraulic system, shown in Fig. 1, does not require a reversing mechanism at the pump. The lubricant is forced through the circuit in one direction only. The speed of the pump determines the frequency of lubrication, which can be varied from one minute to two hours, and the quantity of lubricant given to each bearing can be adjusted from a drop to the maximum capacity of the valve. Adjustments for frequency are made at the pump. There is an indicator for all primary pistons which may operate an electrical flash signal at any position convenient for the operator.

This system has a primary piston directing the flow of lubricant to a plurality of discharge pistons. With its very few moving parts, and the elimination of a reversing mechanism, it is simple in construction and compact, and can be built into a machine tool as a part of the machine, instead of having to be attached to the outer surface. It is possible to connect to a large number of bearings in a small space. The unit will handle either oil or grease. The system can be arranged to discharge either oil or grease from any valve in the circuit. Or, if serving a group of machines, one machine can be lubricated with grease and another with oil, or any machine can be cut off, if desired, without affecting the service to the remainder. It is primarily an automatic system, but is equally simple used as a hand system where the machine does not require automatic lubrication.

In the endeavor to properly and sufficiently distribute lubricant to the moving parts of certain types of equipment, machine builders have depended to some extent on what is commonly known as the splash method. Or, as in the cataract method, they have provided drains from each point of lubrication to a reservoir. The lubricant is pumped from the reservoir into a header line under pressure. Ports in the header line lead to the bearings, gears, slides and moving parts. The excess oil is drained back to the reservoir, from which it is filtered and circulated again to the bearings. This method is somewhat limited, since proper distribution of the lubricant is dependent upon volume pumped and size of port necessary to avoid clogging, which restricts successful application to a limited number of points. The new system, as arranged in Fig. 2, meets every requirement for this type of lubrication, assures delivery of oil to all moving parts, makes it possible to use a filter and pump of reasonable size, and there is the additional advantage over the splash method, that foreign particles are removed by the filtration.

Another late development is an improved measuring manifold to replace the obsolete multiple-tube systems in which the bearings were piped individually to fittings at a convenient place on the machine. This new manifold, shown in Fig. 3, is suitable for jobs where only a few points are lubricated with a portable grease pump or hand gun. There is only one fitting. It provides the measured amount of lubricant required by each bearing with merely the shift of a lever, is adjustable, and has indication at the manifold.

With the use of divisional valves at the bearings, also shown in Fig. 3, it can be made to serve a considerable number of points without excessive tubing.

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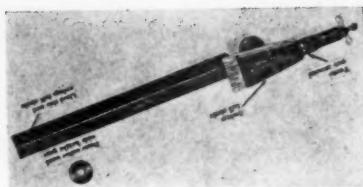
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NEW Equipment

NEW STARRETT INDICATOR "Universal Junior" No. 564 Has Many Applications

The "Universal Junior" Indicator No. 564 just introduced by The L. S. Starrett Company of Athol, Mass. owes its unusual versatility to the complete flexibility of its design. The ball contact, for example, is frictionally held and may be set to touch the work at any desired angle. The sleeve which holds the contact point can be turned completely around, and the entire indicator can be swung through a full



circle when mounted on the shank. This makes it possible to keep the graduated scale in the most comfortable and convenient position for easy reading regardless of the operation or nature of the work. Physical strain and eyestrain are eliminated, double graduated scales or mirrors are unnecessary and quick, easy setups are made possible.

The indicator can be mounted on the

side of one end of the shank or on the top of the other when used in the tool post of a lathe, or it can be removed from the shank and attached to the jaw of a height gage. Readings are made in thousandths over a range of .012 by means of a needle and graduated scale. All parts

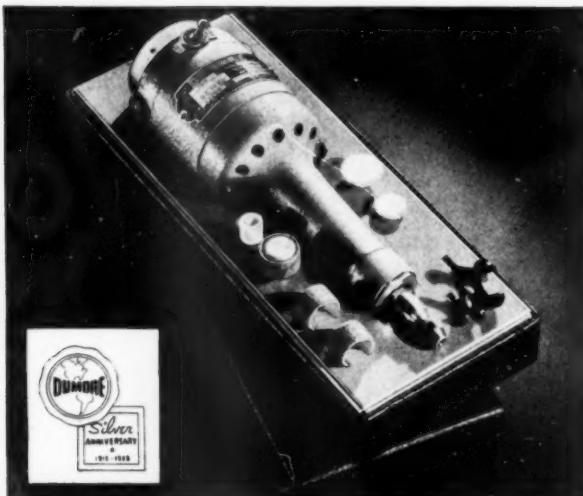
DUMORE HAND GRINDERS GIVE EXTRA Power Hours

An off-hand grinding tool is only as dependable as its motor . . . as flexible as its design. In developing a line of modern hand grinders, Dumore has spared no effort to obtain maximum efficiency with minimum weight and bulk . . . to build-in many extra hours of trouble-free power by precision manufacturing methods. The new Dumore No. 10, for example is compact, well balanced, easy to handle and weighs but 2 lbs. 12 oz., yet it develops 1/18th h.p. at 20,000 r. p. m.

In all Dumore hand grinders, armatures are dynamically balanced . . . windings are pre-expanded, then sealed to prevent centrifugal "breathing" . . . commutators are ground concentric with bearings to assure longer brush life . . . armature leads are swaged to the commutators for 100% contact by the special Dumore process . . . motors are run-in to seat brushes . . . and every tool undergoes five-time inspection in manufacture.

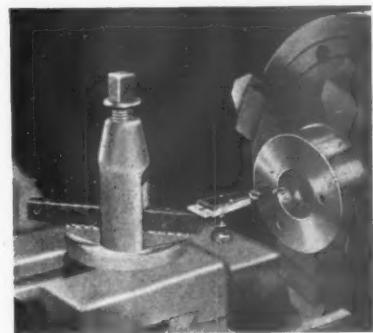
Before you purchase any off-hand grinding equipment, investigate the advantages that Dumore offers. Dumore distributors will gladly demonstrate any tool, or complete information will be furnished from the factory . . . all without obligation.

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are case-hardened steel or die-cast. The indicator case is 2 1/2 inches long, 1/4 inch thick and tapers from 11/16 at the scale end to 1/8 inch at the contact point. The shank is approximately 1/4 x 1/2 x 5 inches.

New Stanley Electric Screw Drivers

Stanley Electric Tool Division, New Britain, Connecticut, announces two new portable Electric Screw Drivers, Nos. 02 and 02H—production tools for use wherever assembly work is done with screws or nuts. Advantages claimed for these new Screw Drivers are light weight, compactness and balance which permit their use for close quarter and long reach work. Both Screw Drivers are available in four driving speeds and are equipped with patented adjustable tension clutch, an exclusive Stanley fea-



ture. No. 02 has an enclosed "on" and "off" switch mounted in the rear end bell. No. 02H has an "automatic" pistol type handle with a double pole, trigger type switch.

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Automatic Multiple Rivet Setter With Adjustable Centers

A new automatic, multiple, bench-type riveting unit, that offers greater flexibility in application, has definitely opened new opportunities for lower costs among manufacturers of small volume products. Heretofore, the economies of automatic multiple setting have been confined to manufacturers having large scale production. This has required the design of individual riveters to meet the requirements of each individual assembly. In the past flexibility in a riveter was not a factor.

This new automatic riveter, a product
(Continued on page 39)

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SUPPLIER'S VIEWPOINT

(Continued from page 12)

"And this brings up the all important item of gaging equipment. Many of our industrial plants now give the same consideration to gaging equipment purchases in their yearly budget set up as they do to machine tool purchases and other necessary tooling expense. The fact is now generally recognized that through the proper use of modern gages a quality product at a minimum cost is assured. The modern and correct definition for a gage is as follows: 'A gage is a device to improve quality, facilitate production and reduce cost.' An excellent example is the use of mechanical and electrical comparators for grading component parts for selec-

tive assembly, resulting in better fits at lower costs. The purchase of gaging equipment should be given the same careful consideration accorded machine tool purchases. The Purchaser should request of the gage manufacturer the services of a competent gage engineer to discuss proposed gage installations. Many times gaging equipment must be roughly designed right on the job with the co-operation of the plant men responsible for gaging practice for successful operation. The final design is made in the engineering department of the gage manufacturer, subject to the approval of the purchaser before proceeding.

"Just a word regarding the purchase of cutting tools, 'The Indispensable Tools of Industry.' When one considers that a machine tool is no better than its tool equip-

ment, it is not difficult to understand why careful consideration should be given the purchase of cutting tools. Many cases have been reported where the yearly expenditure for cutting tools for a machine greatly exceeds that of the original machine cost. Fortunately the majority of manufacturers now purchase their cutting tools on a quality or service basis, following to some extent the procedure common in the purchase of machine tools, rather than being blindfolded by price. Capable cutting tool sales engineers are saving many industrial plants thousands of dollars yearly as a result of studying their various machining operations, recommending tools of the proper design, material and treatment for each operation.

"Recently a manufacturing plant in the Eastern section of the country requested the services of a sales engineer to study a job where 100 high speed steel reamers were being used every fifteen days for reaming parts made of SAE 6135 steel having Brinell hardness of 300-325. The stock removal was .015" on diameter and the holes $\frac{1}{8}$ " long, working to a tolerance of plus .0005", minus .0000". The sales engineer after making a careful study of the job submitted reamers made to a different design and given a special hardening process, resulting in tools to this new design producing 9,000 holes per reamer as compared with 2,000 holes formerly obtained, effecting a saving of \$2,800 yearly on this one job alone. This is a good example of the savings that can be effected as a result of close co-operation between the user and manufacturer of precision cutting tools.

"Quality counts as never before in our history. The rapid production of parts to extremely close tolerances for accuracy and finish at low manufacturing costs with minimum spoilage only can be accomplished by plants employing modern machine tools of the proper design for their operations. These master tools of industry must be supplemented by proper tooling equipment and employment of gages designed to maintain quality, facilitate production and reduce costs. A better quality product at reduced costs means increased sales volume.

"In the final paragraph of Mr. Johnson's paper he emphasizes the importance of having the vendor work with the process engineer and plant supervisor during the early life of a new machine. It is the practice of vendors to supervise the installations of machine tools where such supervision is essential for proper operation as well as keeping in close touch with customer during the early stages of production.

"In closing, may we again emphasize that the vendor always is at the service of the purchaser, welcoming the opportunity of working with the proper individuals. Engineering service is an important factor in sales today and with the co-operation of the purchaser, tools and equipment best suited for the job are installed. The purchaser, therefore, is in a most favorable position to secure a satisfactory volume of business as he is equipped to manufacture products of a high quality at relatively low manufacturing costs with resultant attractive selling price.

"He profits most who serves best' should be the slogan of the supplier and he should live up to it."

(Continued from page 36)
of the Chicago Rivet & Machine Company, is designed with double riveting heads and adjustable centering device. One head re-

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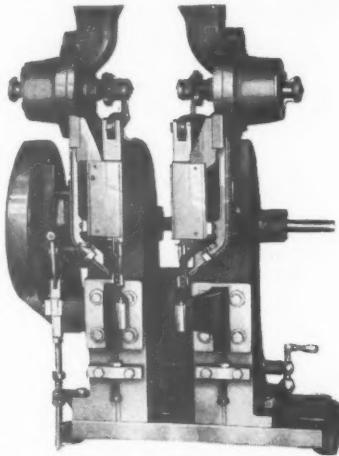
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(Continued from page 36)
 mains stationary, while the other can be adjusted quickly in or out by means of a balcrank and lead screw, requiring only a few minutes to change from one center to another. A 1/4 H.P. motor is employed



in the drive and a single clutch operates the plunger, providing uniform rivet insertion and closure, as well as eliminating marring of the rivet head or unbalanced tension.

Heads may be operated simultaneously to set two rivets at a time or the feed on either head may be locked to permit single rivet setting where necessary or desirable. The greater flexibility offered in this unit requires a minimum of investment in riveting machines.

Two models are available, one for light, and the other for heavy duty work. In operation they are mounted on a bench and equipped with extension trip rod and floor trip treadle. The treadle is jointed and can be moved to any convenient position for an operator. Safety and non-repeating type clutch mechanism are incorporated permitting high speed riveting with safety to the operator.

Further information can be obtained by mentioning "The Tool Engineer" to Chi-



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cago Rivet & Machine Company, 1830 South 54th Avenue, Chicago, Illinois.

Cutter Grinder for Die and Mold Cutters

Cutter Grinder, 375-2, a recent addition to the line of George Corton Machine Co., Racine, Wis., is designed particularly for grinding the highly efficient, time and money saving single flute cutters, which cannot be ground properly on standard types of cutter grinders. It will also grind other types of small cutters, not over 5/8" shank, used in die and mold cutting and pantograph engraving and profiling work—two and four flute cutters and cutters with two, three, or four sides or flats.

The 375-2 Grinder equipped with Universal Tool Head 717-1 will grind cutters to any desired diameter, taper, shape, or clearance, and with square, conical, or ball nose. An index dial and plunger is provided for grinding cutters with 1, 2, 3, or 4 sides. There are micrometer dials on all adjustments.

Carbide cutters may also be ground in any of the above shapes and sizes on interchangeable diamond impregnated wheels. Straight cup wheels are furnished for single flute cutter grinding, and flaring cup wheels for multiflute and spiral flute cutters.

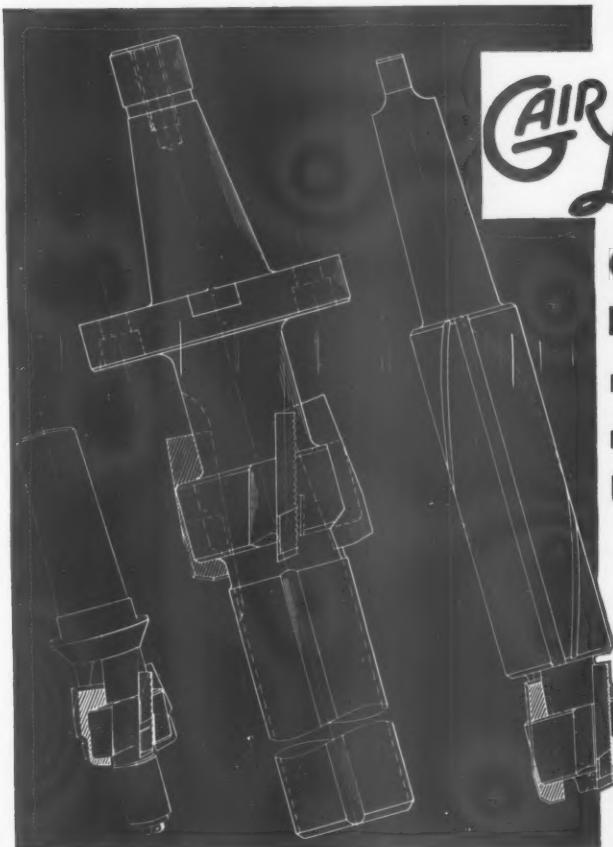
This Cutter Grinder has been built for the most exacting work. It is completely ball bearing, with all bearings dust-proof and running in oil. Simple, positive adjustments for wear are provided at vital points.

New Ex-Cell-O Milling Cutters Reduce Carboly Tipped Blade Cost

With a view toward lowering replacement blade costs on tungsten carbide tipped milling cutters, Ex-Cell-O Corporation in cooperation with the Carboly Company, has developed a new standard line of tungsten carbide milling cutters.

As a result of this standardization program replacement blade and tip costs are

AMPLE Chip Clearance



GAIR-LOCKED Blades provide ample chip clearance -- no clogging of chips in flutes. That's important, for instance, in core drills for rough boring cored holes in castings or forgings -- cast iron, malleable or steel.

Ask for Bulletin 501

The Gairing Tool Co., Detroit, Mich.

GAIR-LOCK BORING BARS AND MILLING CUTTERS --
 SHELL, SIDE, FACE, INTERLOCKING,
 ALTERNATE TOOTH AND MULTIPLE DIAMETER



Blade GAIR-LOCKED in position in cutter head. Patent applied for.

FLUID POWER DEVICES

(Continued from page 16)

Two adjustable pre-set feeding speeds can be obtained by installing a small piston type micrometer adjusting mechanism on top of pump and a small built-in pilot valve brings sharply increased production on many kinds of work where a combination of operations are performed or where wide variations in material or stock are encountered. Either fine or coarse feed can easily be arranged to follow the rapid traverse function. Any number of changes from fine to coarse feed can be made during the cycle. To insure a smooth and positive ram movement resistance is built-up in the feed return line by an internal valve which is only active during the feeding cycle.

Safety against overload to pump, work, tools and machine is insured by pre-set relief valves. These are built into the pump to further eliminate external piping. During the feeding cycle the entire rapid traverse volume is automatically bypassed. During the idle or neutral periods both the rapid traverse and feed volumes are bypassed. A built-in low pressure relief valve keeps the system filled with oil, insures pressure lubrication and maintains back pressure on the feed unit.

On all fluid power feeds, a small compact, adjustable hydraulic delayed reverse attachment may be applied. It provides a time lag or dwell ranging from 1 to 5 seconds at the end of the forward feed stroke. No additional valves, piping or control mechanisms are required. This delayed re-

verse attachment acts directly on the control valve stem. An external trip lever provides emergency release during the dwell, or may be set to omit the dwell. Where electric control is used an adjustable time relay mounted on control panel will provide adjustable delayed reverse.

All functions required are quickly and accurately selected through an integral piston type control valve. The moving table or head can be instantly stopped or reversed at any point in the cycle. Manual, semi-automatic or full automatic control is easily obtained with conventional mechanical load and fire mechanisms familiar to most engineers.

Remote Control Devices

Application of fluid power to new and rebuilt machines can be further simplified by a compact remote controller. This unit is flanged integral with pump (see figure 1) and selects the desired feed and rapid traverse functions through two built-in solenoid operated pilot valves and a four-station control cylinder. Levers, shafts, links, rollers, springs and the like, successfully used in the past for control purposes, are no longer required.

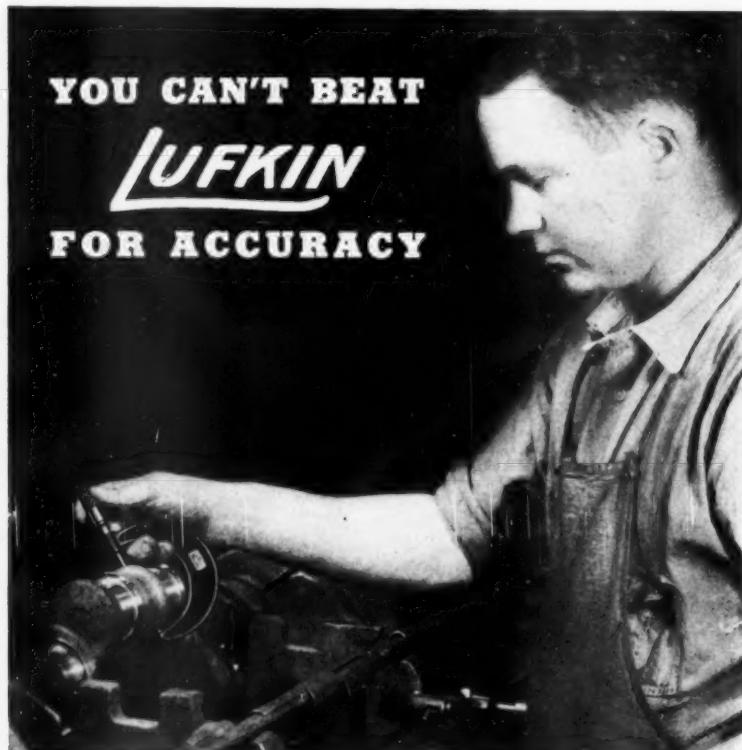
Equipment for a complete fluid power feed installation with remote controller is shown schematically in figure 2. Only two pipe lines connect pump and cylinder. A push button station and small control panel provide convenient manual operation while limit switches actuated by simple adjustable cams on moving table or head provide semi-automatic or full automatic operation. Energizing or de-energizing the two solenoids intermittently or in unison through remote push button stations or limit switches operates the pilot valves and selects the flow of oil to move control valve to the desired positions.

See figure 2 for a semi-automatic cycle using rapid traverse forward, feed forward, rapid traverse reverse and neutral. To start cycle the rapid traverse forward push button is depressed. Adjustable cam (1) trips limit switch (2) changing table motion to feed forward. Adjustable cam (3) trips limit switch (4) reversing table at rapid traverse speed. Adjustable cam (5) trips limit switch (6) and cycle is stopped. Operator can stop or reverse table motion at any time with push button station. For full-automatic operation limit switch (6) can be made to shift pump control valve to rapid traverse forward. Cycles requiring both adjustable coarse and fine feeds, intermittent feeds, delayed reverse and the like are easily obtained with a minimum amount of commercial equipment.

Ability to mount pump in a remote position, convenient to the power source and feed cylinder, makes modern machine design possible at reduced engineering and manufacturing costs. Only a small conduit is required to connect pump with the control station. Thus, it will be found that practically every machine tool need can be met with commercial feed devices of the type described.

Commercial Pumps and Motors

Fluid power application is not limited to the machine tools previously mentioned. Manufacturers of grinding, shaping, planing, honing, slotting, broaching, pressing, stretching, rolling, welding, riveting, die casting and other machines, too numerous to mention, have been quick to grasp the advantages fluid power brings. Fluid power has also proven advantageous on many (Continued on page 44)



It's not only how accurate a new precision tool is that counts, it's how accurate it is after it has been on the job. And that's why Lufkin Precision Tools are the choice of so many top-notch machinists. They're accurate not only when they're new — but after they have given you a lot of long, hard service as well. Because of their design and construction, and because they are made only of special analysis steels best suited to the purpose, Lufkin Precision Tools retain their accuracy after years of use. Ask your dealer to show you these fine Tools or write for catalog No. 7.

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THE LUFKIN RULE CO.
SAGINAW, MICHIGAN

Canadian Factory
WINDSOR, ONT.

TAPES — RULES — PRECISION TOOLS

NOW-MAXIMUM BLADE WEAR AT MINIMUM COST

As the blades are adjusted to take up wear in these new cutters, both the outside diameter and the face are renewed—automatically—and without the aid of pins, wedges or set screws.

In the Roughing Cutter, where the major direction of adjustment and major blade wear are on the periphery, 4 times as much radial as axial adjustment is obtained. And with the Finishing Cutter, where the cutting, or "skiving," is done on the face, 4 times as much axial as radial adjustment is obtained. This "balanced wear" provides far more economy and efficiency than has heretofore been possible with any style of cutter, and is automatically obtained by merely moving the blades out one or more serrations.

MANUFACTURED ONLY BY THE O. K. TOOL CO., SHELTON, CONN.

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NEW
OK
DUAL
ADJUSTABLE
FACE
MILLS

WRITE FOR
COMPLETE
DESCRIPTIVE
CIRCULAR



ROUGHING FINISHING



INSERTED-BLADE METAL CUTTING
TOOL SYSTEM

THIS GRINDER CAN'T FORGET ITS GOGGLES



No Worry About Eye Hazards When You Install Delta Grinders!

Workmen can't forget to take care of their eyes when they use Delta grinders. The safety-glass shields automatically eliminate all common eye hazards.

They have other advantages too! The shields are fitted with built-in lamps that illuminate both the fronts and sides of the wheels. That makes accurate tool grinding a pleasure instead of a chore. It also means you can set the grinder wherever you want in the shop without worrying about proper lighting.

Users say "It's a peach of a grinder!" So smooth-running and well-balanced that you have to look closely to see when it is running. Tool rests are machined all over so you can really adjust them without swearing. Strong, well-made wheel guards with dust-discharge nozzles at the rear. Completely portable.

The ideal grinder for your toolroom and general shop tool-sharpening. Made in bench and pedestal models, any type of $\frac{1}{2}$ H.P. motor. Drop us a line for full information today!



DELTA MANUFACTURING CO.

613 E. VIENNA AVENUE

MILWAUKEE, WIS.

HYDRAULIC RIVETING

(Continued from page 17)

made in 1934 with the development of a portable oil hydraulic riveter by the Hannifin Mfg. Company. After carefully analyzing present day riveting requirements, this hydraulic riveter was designed and put into successful operation. It has so satisfactorily filled the requirements of riveting that it has been almost universally adopted by the automotive industry for riveting frames.

With this riveter it is now possible to take advantage of the tremendous forces developed with hydraulic power to set rivets cold. This is significant since tests indicate cold riveting makes a tighter and stronger joint. In addition to the fact that the rivet completely fills the hole before the head is formed, cold rivets, annealed, are superior to hot driven rivets due to the increase of strength developed by the cold working of the steel. Since pressures required for heading cold rivets are approximately double those for heading hot rivets, the design of the C-frame is very important in order to obtain a com-

pact and portable machine.

The 17½-ton portable riveter shown in Figure 1, is used to squeeze ¾" cold rivets in automobile frames. The riveter C-frame is designed for maximum lightness and portability. The total weight including operating cylinder is only 54 lbs. The use of chrome-nickel steel forgings, accurately machined, with absolute control of heat treatment allows the weight and bulk of the riveter to be reduced to a minimum. The portable riveter is operated at a maximum pressure of 5000 lbs. per square inch, being produced by the Hannifin "Hy-Power" Generator.

This generator is a combination of a 1000 lbs. per square inch electric motor drive primary oil pump, valve mechanism and intensifier, operating in an automatic cycle. This unit is self-contained, occupying a floor space of only 17" x 32". (Shown in Figure 1.) The fluid pressure developed in the generator is transmitted through flexible high pressure hose to the portable riveter. Control of the riveter is entirely in the operator's hand; that is, by depressing a pilot switch incorporated in the portable

riveter the generator automatically completes a cycle squeezing a rivet. At the end of the return stroke, the controls shift the valves to neutral and the pump then circulates oil under zero pressure.

With the semi-automatic cycle, the operation of this hydraulic riveter is absolutely positive, without the possibility of a repeat cycle occurring, unless the pilot switch is released and again actuated. The operating cycle is 2½ seconds for the 17½-ton riveter. This equipment brings to industry all of the advantages of present day skill and design in effectively utilizing hydraulic power without the faults and disadvantages of the hydraulic riveters previously used.

Applications of Portable Riveting

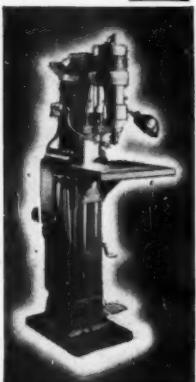
For a portable riveting machine in which considerable power is wanted, there is no more efficient or direct means of transmitting power than by the application of hydraulics. High pressures are used without experiencing difficulty in joints or hose. High pressures are extremely advantageous for portable machines where savings of weight are so great an object. The high pressures used permit the use of small diameter cylinders providing maximum work clearance. Using hydraulic pressures at 5000 lbs. per square inch, no trouble is experienced as the safety factor is increased and accidents with machines operated by oil pressure are reduced to a minimum. Operating with oil, the maintenance of the machine is slight, and the work is done in perfect silence with no vibration of machinery. The power of control obtained is of the greatest importance in riveting; it does away with all necessity for the care usually required in regard to length of the rivets, as the machine automatically reduces the stroke to suit a long rivet, while if the rivet is too short, it still closes the plates equally well by increasing the stroke. The hydraulic riveter possesses the great advantage of certainty and uniformity of the work done, every rivet being closed with the same pressure, supplied only at the pressure to which the generator is adjusted.

(Continued on page 44)

WHY HASKINS DELIVERS TOP TAPPING PRODUCTION CONSTANT PRECISION LIMITS ARE OBTAINED IT PAYS TO HAVE HASKINS FROM THE START



REASON ONE—The precision tools, equipment and workmanship used to build speed and endurance into the Haskins Tapper. The constant modernization of Haskins' own plant (in which 95% of all Tapper parts are made) with the newest in efficiency methods and precision equipment. Only precision maintained shop equipment can produce precision tapping machines.



REASON TWO—The exclusive features of design, engineering and construction which distinguish the Haskins Tapper. Haskins pioneered such features as foot pedal control, rigid no-float spindle, instantaneous reversal of tap spindle. These mean quicker handling of parts, reduced operator fatigue, closer tolerance.



REASON THREE—Haskins Engineering Service—a vital part of the exclusive Haskins Method. Haskins Engineers regularly work out new fixture designs that simplify and speed up troublesome jobs.



REASON FOUR—Each Haskins field representative is a tapping authority. A trained tapping specialist able and willing to solve difficult problems. Haskins Service begins where most service ends—with the sale!



REASON FIVE—The actual performance records chalked up by Haskins Tappers on every type of tapping job. The one illustrated—tapping two blind holes in a die casting—has been greatly simplified by the use of a Haskins designed swing fixture that minimizes handling operations and eliminates the need for clamps.

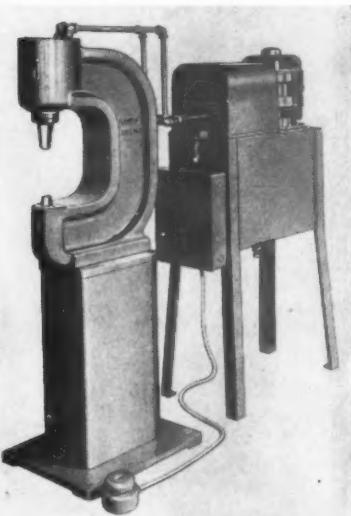
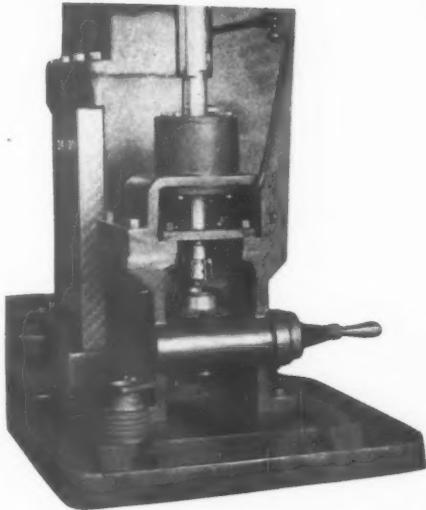


Fig. 2—The hydraulic riveter, self contained, with individual motor drive, is readily adaptable to a variety of uses as for example the stationary riveting press shown above.

HASKINS PRECISION Tapping Equipment

Q-C ENGINEERING



BORING FIXTURE
AIR COMPRESSOR CYLINDER
ENTIRE TOOL THRUST TAKEN THROUGH LOCK.

Q-C FIXTURE LOCKS CARRY THIS UNQUALIFIED
GUARANTEE:

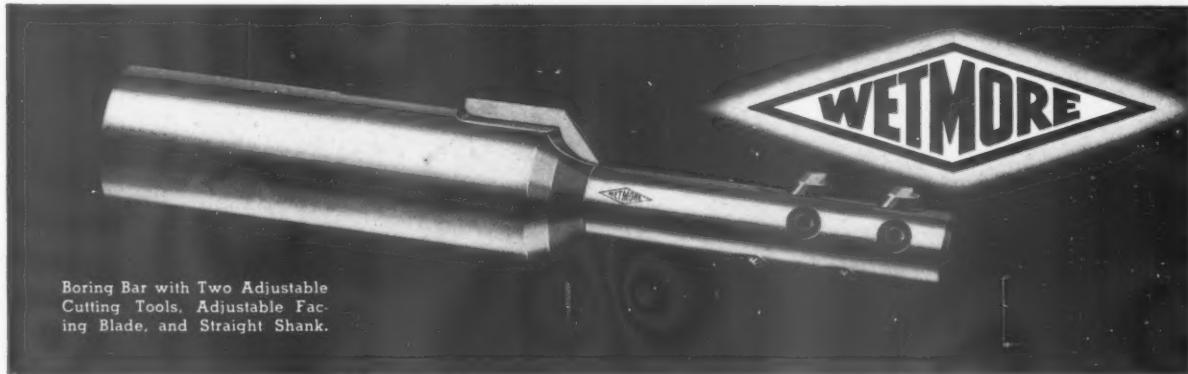
WHEN INSTALLED CORRECTLY, TO OUTLIVE FIVE
YEARS OF INTENSIVE USE,
THAT NO AMOUNT OF TOOL PRESSURE OR
VIBRATION WILL OPEN LOCK;
POSITIVELY NO BACK LASH OR SLIPPAGE.

Four sizes available for mounting on fixtures of your
own design. Single or Double Acting.

Q-C ENGINEERING PRODUCTS

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OFFICES 2842 W. GRAND BLVD. PLANT 6666 TIREMAN
DESIGNERS—BUILDERS
DIES—JIGS—FIXTURES—SPECIAL MACHINERY
STANDARDIZED UNITS

ANOTHER WETMORE BORING BAR THAT CUTS TIME AND COSTS



Boring Bar with Two Adjustable
Cutting Tools, Adjustable Fac-
ing Blade, and Straight Shank.

WETMORE FEATURES:

- eliminates present slow, costly, unreliable methods of adjustment.
- provides rapid, accurate adjustments in either direction with graduated screw.
- wedge lock positively and solidly locks tool without changing setting.
- rugged construction of bar and firm grip of cutting tools by wedge lock adds to cutting life by elimination of vibration.
- adjustment and wedge lock adaptable to all types of speed bars; boring units are adaptable to all types of boring and turning heads.

Send in your drawings—Wetmore Engineers will design tools to reduce tool-setting time and cost per piece machined.

See your Wetmore representative for many surprising possibilities and applications.

WETMORE REAMER COMPANY

Dept. TL 420 N. 27th St.

MILWAUKEE, WIS.

FLUID POWER

(Continued from page 40)

phases of rotary drives in steel, rubber, paper and printing industries. The specific power and control requirements of each application in this vast field of power transmission can now be met with commercial pumps and motors.

Constant and variable displacement pumps and motors, similar to the unit shown in figure 3, are available in conventional sizes from 2 to 150 horsepower and peak capacities up to 190 horsepower. Each size is offered with one, two or three pumps having working pressure ratings of 1100, 1700 and 2500 pounds per square inch and peak pressure ratings up to 3000 pounds per square inch. Compact, interchangeable, flanged control devices of vari-

ous types for every size of variable stroke unit make possible almost human control of the volume discharged with exceptional accuracy.

For direct control of pump discharge there is a hand-wheel control direct on a screw shaft and a micro-screw control with worm-wheel on screw shaft and hand-wheel on worm shaft. Remote control by push-button stations or limit switches is possible through an electric geared-head motor and reduction unit. Sensitive rapid acceleration, controlled follow-up or reversal of pump discharge is available through a simple lever type hydraulic servo-motor control. An automatic unloading control permits a pre-set pressure to be maintained on system continuously without excessive heating or power loss. A hydraulic remote control provides remote



Fig. 3. Two way Variable Displacement Pump with Sensitive Lever Control, Base Reservoir and Direct Motor Drive.

selection of two accurately pre-determined adjustable speeds. Another control provides rapid-traverse, coarse feed, fine feed, rapid traverse and neutral through an integral control valve. For precision speed control there are both pendulum and disc type controls. Double features and functions are obtained by combining two of these interchangeable controls on one variable displacement pump unit.

High speed rapid traverse speed at pressures up to 300 pounds per square inch in combination with slower working speeds at pressures up to 3000 pounds per square inch are available with similar constant and variable displacement duplex pumps.

Space will not permit amplification on the construction, principle of operation and application of this comprehensive line of pumps and motors nor the functions and features of the many controls. Commercial fluid power feed devices are legion; there is a specific unit for almost every power transmission need.

AS THE TOOL ENGINEER SEES IT

(Continued from page 10)

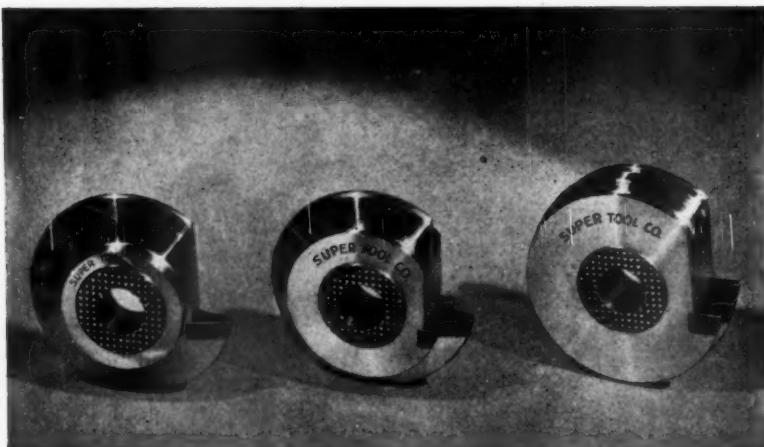
vendor's reputation in doing a job which reflects upon his ability to do this job under consideration. We really buy machinery on the basis that the supplier thinks he can do the job, rather than that he guarantees he will do it. He is as good as his word. Thank you.'

HYDRAULIC RIVETING

(Continued from page 42)

The "Hy-Power" Hydraulic Riveter being self-contained with individual motor drive, can readily be adapted to a variety of portable or stationary riveting presses. A typical example of a stationary press is shown in Figure 2. Operation is the same as provided for the portable riveter except for foot control switch. This type of machine is used for sub-assembly riveting.

Another interesting application of riveting is shown in Figure 3. Here the 35-ton



These Circular Forming Tools with Cemented Tungsten Carbide Tips are producing more work—and better work—at lower cost per piece.

Let us figure on your requirements of Standard or Special Carbide Tipped Tools, or advise you regarding possible new applications.

Write for our catalog and price list

SUPER TOOL COMPANY
356 E. Congress St., Detroit, Michigan

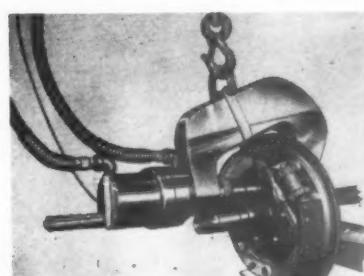


Fig. 3—Another application for portable riveters is shown by the 35-ton model, setting cold rivets in the backing plate to rear axle truck housing assembly.

VICE

For DRILL PRESS. Often Used on MILLER, SHAPER or PLANER
Jaws 6", 9" and 12" Long

Fig. 1 With Jig Attachments



The Attachments mean much duplicate drilling without expensive jig making.

A simple single-purpose jig will cost more than Vise, Fig. 1, which will do many jobs.



Fig. 2

Same Without Jig Attachments

Flanged at bottom for bolting down, with slots at large end,—not shown. All Vises are drilled to take Jig Attachments. These holes are convenient for attaching stops.

ANY VISE WILL PAY

More time lost catching work than drilling.
Send for Circulars

THE GRAHAM MFG. CO.
72 Willard Ave. PROVIDENCE, R. I.

**TAKE A NUMBER
FROM .1001 TO .1009**

- For only \$3.50, Johansson produces a steel block that will measure this dimension in ten-thousandths with an accuracy of $\pm .000008$ inch.
- Johansson sells 174 gages individually—over $\frac{1}{2}$ of them priced at only \$3.50. In addition, twelve standard sets in cases are available, varying from 5 blocks to 81 blocks. Sets range in price from as low as \$26.50 to \$295.
- Johansson Blocks are the utmost in precision gages. No individual workman, no shop or plant need suffer from lack of accuracy when Johansson offers such a variety in prices. Catalog No. 12 contains complete information. Write to Dept. J.

C. E. JOHANSSON DIVISION

JOHANSSON
ACCURACY

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DEARBORN
MICHIGAN

JARVIS

Quick Change Chucks and Collets

Extreme accuracy, tremendous torque capacity and absolute safety are the outstanding features of the JARVIS QUICK CHANGE CHUCKS AND COLLETS.

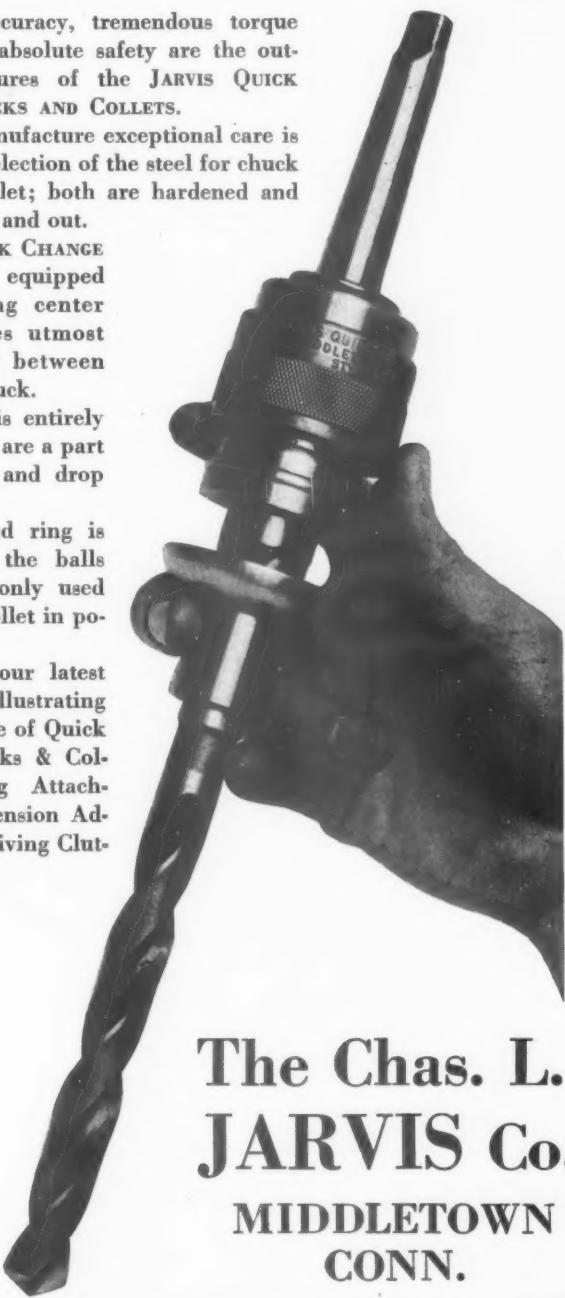
In their manufacture exceptional care is taken in the selection of the steel for chuck as well as collet; both are hardened and ground inside and out.

JARVIS QUICK CHANGE CHUCKS are equipped with a spring center which assures utmost concentricity between collet and chuck.

The drive is entirely by lugs which are a part of the collet and drop forged.

The knurled ring is floating and the balls beneath are only used to hold the collet in position.

Write for our latest catalog T-5 illustrating our entire line of Quick Change Chucks & Collets, Tapping Attachments and Tension Adjust Screw Driving Clutches.



**The Chas. L.
JARVIS Co.**
MIDDLETOWN
CONN.

GLENCO

COMPENSATING TOOLHOLDER

Corrects Machine Tool Misalignment By
Producing **TRUE** and **ACCURATE** Holes



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THE J. C. GLENZER CO.

DETROIT,

MICHIGAN

FOSIER



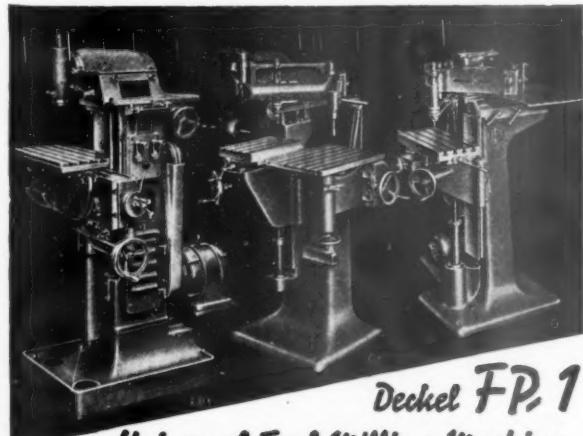
SMALL SCREW MACHINES at the TAYLOR INSTRUMENT COMPANY

There are good reasons why this well-known manufacturer of accurate recording and controlling instruments use Foster screw machines.

Here accuracy, flexibility, precision and production are of most importance.

Foster machines have features of productive value you should investigate before selecting your screw machine equipment.

FOSTER MACHINE COMPANY
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Deckel FP 1
Universal Tool Milling Machine
for tools, jigs, gauges, moulds, dies and punches.

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(3-Dimensional Pantograph)

for plastic moulds, die casting dies, drop forging dies, metal embossing dies, profiling.

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for general sunk and raised letter engraving.

H. P. PREIS ENGRAVING MACHINE CO.
157 SUMMIT STREET, NEWARK, N. J.

OIL POWER MOTORS

(Continued from page 13)

be obtained easily by means of proper trip dogs.

Slides and carriages can also be electrically controlled by means of solenoid valves. These valves serve to actuate the main control valves in the pumping unit and are in turn actuated by means of limit switches contacted by dogs on the machine slide. One solenoid valve starts the cycle when energized and produces neutral when de-energized. A second solenoid valve produces rapid traverse during the time it is energized and feed when de-energized. A third causes reversal when momentarily energized.

The standard circuit provides rapid approach, one rate of feed, and quick return. The addition of a fourth solenoid valve gives two rates of feed and a fifth can be added to the circuit to give three feed rates when desired.

Tank Units simplify the installation and connection of hydraulic units to machines. With electrical control, the only piping required when assembling the unit to the machine are the two pipes leading to the cylinder for the fluid motor as the case may be. The use of tank units is especially desirable when lack of room forbids mounting the pump units directly on the machine or space for an oil reservoir inside the column or elsewhere is not available. Further, all parts are made accessible for inspection.

Fluid motors are also suitable in combination with pumps to provide the drive mechanism for many types of machine tools. On grinders, a hydraulic transmission can be employed to revolve the work or the grinding wheels. Hydraulic drives are also suitable and are being used to rotate the cutting tools on drill presses, radial drills, and milling machines, also to drive the spindles in lathes and many other machines with highly satisfactory results obtained on such applications.

FROM THE SHOP VIEWPOINT

(Continued from page 11)

ment, and orders monorails and conveyors, etc. He then turns over the selected proposal with additional orders to the purchasing department for actual order.

"We will not, at this time, dwell on the functions of the purchasing department as that is assigned to another speaker. We can, however, state that in cases of special equipment such equipment is demonstrated by the vendor and must be made to perform its functions satisfactorily as covered by the vendor's guarantee. It is still a responsibility of the production engineering department to see that the equipment is satisfactorily demonstrated, after which the invoice will be approved by the production engineering department for payment by the purchasing department.

"Mr. Johnson has covered in such great detail the routine that should be followed and in my remarks I have tried to briefly point out some of the peculiarities of our work and, while we agree in principle on the method as outlined, you will note that there are a few conditions where we do have to deviate possibly from your standard practice."

Have you obtained your Standard Data Sheet binder? These are available at nominal cost from A.S.T.E. Headquarters, 2567 W. Grand Boul., Detroit. Write for details.



The Winners!



FIRST PRIZE--\$100.00

"Why I consider the Eclipse Radial Drive the outstanding interchangeable construction for end-cutting production tools:

- (1) Rapidity of inserting counterbore and ejecting same.
- (2) Concentricity, Accuracy, Rigidity. No wedging action, small diameter feature of holders.
- (3) Strength of drive and positive absence of shearing, jamming, elimination of excessive torque, short drive, constitute the valuable features of this great design.
- (4) Long life of counterbore flutes will be a distinct saving to customers.
- (5) The vital item of safety to operators, tools, fixtures and machines, denotes foresight of design and marks a great step forward for the Eclipse Counterbore Company and users of fine tools."



DEWITT C. RADCLIFFE,
119 Osborne Street,
Wissahickon
Philadelphia, Pa.

Wins first prize for
this letter.



SECOND PRIZE--\$50.00

"The Eclipse Radial Drive is outstanding because—

It is an interchangeable, positive radial drive on two integrally formed lugs arranged for holder and cutter between concentrically aligned diametral bearings, which maintain a balanced driving action between holder and cutter on a thrust bearing as close to the cutting edge as possible, to minimize torque.

And yet in its simple design, it has a change-over feature that engages or disengages one tool for another by a quarter turn of the hand.

Also, you do not sacrifice efficiency to maintain low tool cost and economical operation, when you employ Eclipse Radial Drives."



EDWIN F. JAHN
12116 Corbett Avenue
Detroit, Michigan

Winner of Second Prize.
Here is his letter:



ECLIPSE COUNTERBORE COMPANY
DETROIT 7410-30 ST AUBIN AVE MICHIGAN

New Equipment

(Continued on page 39)

materially reduced. A sliding scale of quantity prices has been adopted. In addition, the standardization move will speed up deliveries.

Under the arrangement, both Carboloy Company and Ex-Cell-O representatives will accept orders for Ex-Cell-O replacement and original cutters as well as original and replacement blades at newly established standard prices.

The new Ex-Cell-O milling cutters incorporate the Continental Type "RC" blade lock, selected for its simplicity of construction and adjustment, ruggedness, and economy in operation.

In this construction, taper blades fit into accurate tapered seats, blade supports being integral with the cutter body. Blades may be adjusted individually any desired amount, according to the grinding necessary on each blade—reducing grinding

time and eliminating wastage of tungsten carbide in sharpening blades.

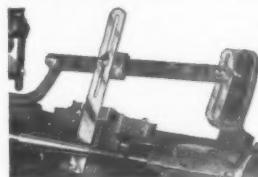
Further, this type of blade lock facilitates set-up or changing of blades, since blades are locked in place in pairs with an external clamp requiring only a turn of an Allen wrench to either tighten or ease the clamp. A light tap then releases any individual blade from the cutter body for adjustment or replacement of a single blade.

Other advantages of this type of construction include the assurance of maximum heat conductivity through the provision of accurately fitting full-face blade seats, and security of blade lock without need for end stops.

Frank L. Avery, Managing Director of Controlled Circulation Audit, who audits the circulation of "The Tool Engineer" has time to invent the Taper attachment for the Atlas Bench Lathe, shown here. Last fall Mr. Avery had ideas about a new-type taper attachment and presented

his ideas to The Atlas Press Company and assisted them in preparing the new attachment for production.

The advantages of the Avery attachment were recognized at once. It is simple in design, quickly installed, and priced



at but a fraction of previous attachments. Copies of Atlas catalog No. 28, containing a complete description are available from The Atlas Press Company, Kalamazoo, Michigan. Mention "The Tool Engineer" when writing for your free copy.

South Bend 1-Inch Collet Lathe

A new 9-inch swing lathe with a 1-3/8" hold through the spindle and 1-inch collet capacity is announced by the South Bend Lathe Works, South Bend, Indiana.

This new 9-inch Lathe is a back-geared screw-cutting lathe, with all engine lathe features, and has been developed especially for the manufacturing plant and the tool room. All regular attachments are available. Draw-in collet chuck attachment may be had in the handwheel type and the quick acting lever type; six tool bed turret and double tool slide adapt the lathe to handling multiple operation manufacturing jobs; telescopic taper attachment permits doing the most precise taper work; electric grinder, chip pan, collet tray, carriage stop, and milling and keyway cutting attachments are also available.

The new 9-inch large spindle hole lathe is manufactured in several different types including the Underneath Belt Motor Driven Lathe, the Tool Room Lathe, the Horizontal Adjustable Motor Driven Bench Lathe, and the Countershaft Driven Lathe.

A two-speed motor drive provides twelve spindle speeds ranging from 50 to 1400 R.P.M. The Quick Change Gear model cuts screw threads from 2 to 112 per inch and the Standard Change Gear model cuts threads 4 to 112 per inch. Power longitudinal feeds are .003" to .020" and .002" to .015" respectively. Four bed lengths are available; 3-ft., 3 1/2-ft., 4-ft., and 4 1/2-ft.



The new South Bend 1-inch collet lathe is the new Series "R" model, which features (Continued on page 53)

ARE YOU WASTING TIME FITTING ODD SHAPES

?

?

?



Boyar-Schultz HIGH SPEED PROFILE GRINDERS With Sine-bar Table Adjustment

Save Time . . . Save costly hours of tedious stoning when fitting irregular shapes, difficult profiles and contours for dies, punches, gauges and templates, or any other work that requires accuracy in fitting.

Light in weight, the Boyar-Schultz PROFILE GRINDER is easily portable, permitting use wherever it is most convenient.

Its high speed—approximately 20,000 R.P.M.—with reciprocating spindle assures a fine ground surface as well as even wear to wheels—saving wheel costs.

If you have work that demands fitting to the close limits necessary in modern tool and die practice, you will want to know more about this Precision Machine Tool.

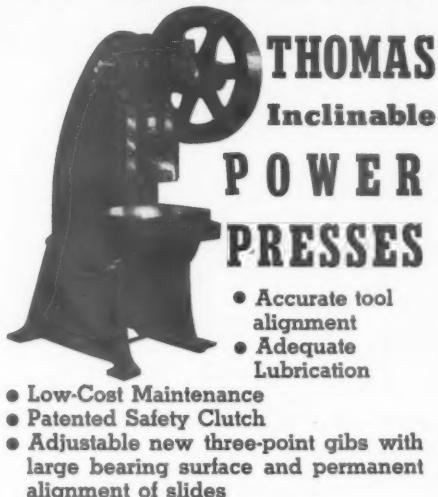
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MACHINE MANUFACTURING COMPANY

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FABRICATING MACHINERY

GAMMONS
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**PRODUCTION TOOLS**

ORIGINATORS AND
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FLUTED TAPER PIN REAMERS

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HOLDING AND STRAIGHTENING MACHINES • MULTIPLE DRILLS

Plain
Stationary
Press
Fit—
Type
"P"



Shouldered
Stationary
Press
Fit—
Type
"S"



Removable
Slip
Type
"R"

Also manufacturers of complete machine parts, specializing in hardened and ground parts requiring extremely close limits, lapped fits, etc; also hydraulic appliances for pressures up to 20,000 lbs. per square inch.

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CHICAGO, ILL.

**Like the Poor,
Broken Taps are
Always With Us!**

That's why you can't afford to try to get along without a

**WALTON TAP
EXTRACTOR**

It Backs Out taps broken off short, without annealing, drilling or use of special tools. Saves its cost on first use, whether on Production or Maintenance Work.

Stocked in sizes from No. 4 to 1½".
Styled to fit 2, 3 and 4-flute taps.



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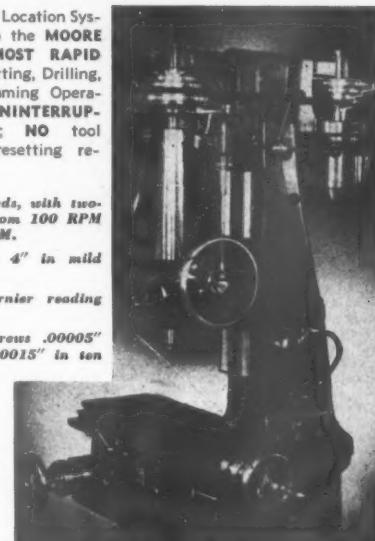
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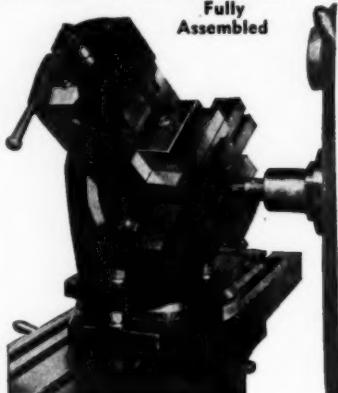
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They quickly pay
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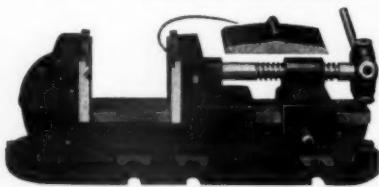
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GEM VISES are designed to be adaptable, time-saving tools on a wide variety of production, tool-room and maintenance operations. Constructed to stand up and give long service, and complete satisfaction; they soon pay for themselves in time saved.

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Length 18½"
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Net weight 97 lbs.
3 ¾" bolts hold vise on swivel base.



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The new ARMSTRONG Hollow Screw Wrench Set No. AL-100 provides strong, handy, well balanced quality wrenches exactly suited for each job—ratchet wrenches, "T" wrenches, off-set wrenches, wrenches of almost any usable size or shape . . . wrenches that work in close quarters around dies and jigs, that reach into machinery or up to shafting . . . strong wrenches that will take a tight set, for all hex-socket hollow screws from $\frac{1}{4}$ " to 1" diameter. Designed for severe lifetime service, ARMSTRONG Detachable Hollow Screw Wrenches are of special Chrome Vanadium Steel, machined to accurate limits, heat treated and tested to assure maximum strength. ARMSTRONG Reversible Ratchets are drop forged, have an improved instant-reverse action and hardened steel gears. Extensions and Handles are of Chrome Vanadium steel. Larger wrenches and parts (1½" drive) have the patented ARMSTRONG DriveLock feature that prevents heads or parts from separating. All wrenches and parts are chrome plated. Write today for the new Hollow Screw Wrench Circular.

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other desired combination. Write for circular and
prices.

C. A. NORGREN CO. Inc.
218 Santa Fe Drive
Denver, Colorado

NEW EQUIPMENT

(Continued from page 48)

tures a heat treated headstock spindle with all bearing surfaces hardened and ground; spindles of special alloy steel, with phosphor bronze bearings, line bored and lapped, and adjustable for wear; new double wall apron with self-oiling steel gears; and, a multiple disc friction clutch.

The company is issuing a new bulletin in No. 29, illustrating, describing and pricing the new South Bend 9-inch Large Spindle Hole Lathe. Any reader interested in securing a free copy may write the Technical Service Department, South Bend Lathe Works, South Bend, Indiana.

Hobart Brothers Announce New Improved Line of "Multi-Range" Arc Welders

1,000 Available Combinations of Voltage and Welding Current is the keynote of announcements of a new line of "Multi-Range" Arc Welders by The Hobart Brothers Company, Troy, Ohio.

The result is said to be a complete absence of "dead spots," closer control of the relationship between open circuit voltage and welding current—and a smoothness of operation that's remarkable. Oscillograph tests and reports from operators also indicate improved stabilization as a result of the special windings, extra turns and added copper which provide reactance



of just the right degree for each of the ten welding ranges. The reactance may thus be said to be "automatically varied to suit actual welding requirements."

Hobart's popular "Remote Control" feature is retained and improved. The Volt-Amp Adjuster is now located compactly within the ten-range dial where it automatically plugs in or out when used on the machine or at any distance away. Only an ordinary lamp cord extension is required to place the Volt-Amp Adjuster conveniently close to the hand of the operator, wherever he may be working. This saves countless steps and insures better welding by removing the temptation to "get by" with one machine setting for different welding positions or rod sizes. The welding ranges are easily selected by turning a large hand wheel of steel covered with hard rubber, conveniently located on the front of the "Turret Top" control cabinet, while the indicating dials are clearly and attractively marked in colors of black, red and silver. Separate voltmeter and ammeter are also provided (optional with "Junior" models), flush mounted on the front panel.

Mention "The Tool Engineer" when writing or inquiring for further details.

Bench Model High Speed Precision Profile Grinder

This new bench model machine tool eliminates costly hand stoning in fitting of dies and punches, accurately finishing templates, gauges, cams and special shapes. The tool is known as the Boyar-Schultz Profile Grinder and is manufactured and sold by Boyar-Schultz Corporation, 2110 Walton Street, Chicago, Illinois.

Portable, low in price, the Boyar-Schultz Profile Grinder is built with a unique precision spindle that revolves at 20,000 R.P.M., and handles various sizes of grinding wheels. The revolving spindle is instantly adjustable to provide reciprocal movement in a vertical plane. As the grinding wheel revolves, the reciprocal

movement assures even wear to the wheel and gives the utmost in smoothness of the surface ground.

The work table has a sine bar adjustment feature so any angular setting up to 5 degrees may be made with utmost assured accuracy. Furnished with the machine for positive attachment to the work table is a specially designed diamond wheel dresser. Motor and all moving parts except grinding wheel are enclosed in ventilated cast aluminum housing.

Mention "Tool Engineer" when inquiring about the new tool.

New Light Weight Portable Pneumatic Riveter

A compact, light weight Portable Pneumatic Squeeze Riveter for setting $\frac{1}{4}$ " and $\frac{5}{16}$ " rivets cold is now available.

(Continued on page 54)

New AMERICAN STANDARD CHUCKS by "LOGAN"

"Logan" Power Chucks now conform to American Standard Specifications. The inherent factors of strength, balance, rigidity and precision which have made "Logan" Chucks famous for positive, LASTING accuracy and operating efficiency are now further refined and improved.

A new catalog describing the complete "Logan" Chuck Line is ready for distribution. Your copy will be mailed upon request.



LOGANSPORT MACHINE, INCORPORATED, LOGANSPORT, IN

Manufacturers of "Logan" Air and Hydraulic Power Devices, Chucks, Cylinders, Val-

NEW EQUIPMENT

(Continued from page 53)

As illustrated it may be used for setting vertical rivets or rotated for driving horizontal rivets. The complete machine weighs less than 100 pounds and may be suspended from a balancer to provide all vertical movement. A universal suspension bail permits the use of the riveter in any position also tilting from side to side to more easily enter some work. The operating valve is in the rear cylinder head and is used to guide the riveter. After completing the power stroke the valve automatically reverses, returning the dies to the "open" position ready for the next rivet. An operating speed of fifty strokes per minute and the compactness of the riveter assure maximum riveting speed. The yoke may be of whatever design and reach is needed to "fit the job." Manufactured by the Hanna Engineering Works, 1765 Elston Avenue, Chicago, Illinois.

Armstrong Announces Wrenches For Hollow Screws

Armstrong Bros. Tool Co., Chicago, announce a new line of wrenches for hollow screws. Now instead of wrenches formed from lengths of hexagonal bar stock, the hollow screw user can assemble a tool of size, shape and length needed from a set of interlocking drivers, handles, extensions and ratchets.

The Armstrong Hollow Screw Wrench resembles in general a detachable head of a socket wrench, but in place of a socket to fit over a screw head, they have a protruding hexagonal driver that fits into the hollow screw. Ten sizes fit all hex nut

hollow screws and cap screws from $\frac{1}{4}$ " to 1" diameter. An AL-100 Set illustrated, consists of 10 wrenches, 2 reversible ratchets, 3 sliding T-handles, 2 extensions and an adapter in a fitted steel case. The wrenches, handles and extensions are made of Chrome-Vanadium tool steel. The reversible ratchets are drop forged with hardened steel gears, and it is claimed have an improved action. All wrenches and parts are chrome plated.

Huther Circular Saw for Cutting Non-Ferrous Materials

The Huther Brothers Saw Manufacturing Company, Inc., Rochester, N. Y., has developed a circular saw for cutting non-ferrous metals, fibres, and plastics. The saw teeth are tungsten carbide tipped. The saw is segmented, five teeth to a segment, each tooth being tipped with a Firthite sintered carbide tip manufactured by the Firth-Sterling Steel Company, McKeesport, Pa. In case of damage to a tooth, a segment may be replaced quickly, and a damaged saw does not become a complete loss.

An application of the saw in an 11 inch diameter, $\frac{1}{16}$ inch face is the cutting of Micarta laminated plastic steel mill bearings to the proper segment arc.

The New Pratt & Whitney No. 1 1/2B Jig Borer

Pratt & Whitney, Division Niles-Bement-Pond Company, Hartford, Conn., has developed a new Jig Borer known as the No. 1 1/2B. In principle it is like the larger P&W No. 2A and No. 3B Jig Borers and is capable of working to the same close tolerances of ten-thousandths.

The machine has a special long table with a 10" x 48" working surface and a 42" longitudinal travel. The variable speed spindle drive is through hardened spiral bevel gears running in an oil spray. There are eight spindle speeds ranging from 130 to 1800 R.P.M., so that the machine is equally adaptable for drilling, boring or reaming. The hardened, ground and precision lapped spindle quill is 3" in diameter and has a 5" travel which permits boring holes of an unusual depth for a machine of this size. The spindle, which has a No. 2 Morse taper hole, is mounted on permanently sealed, preloaded precision ball bearings.

The open-side construction and the vertical spindle is ideal for precision work, as the direct thrust of the cutting tool is taken upon a horizontal table supported by a heavy, rigid bed. This type of construction simplifies holding the work, enables the operator to follow the progress of his operations more closely and makes possible the use of a wider range of rotary table applications.

The table traversing screws are in no sense lead screws and have no connection with the measuring instruments. Errors or wear in these screws will not in any way impair the accuracy of the work produced by the machine. The measuring instruments, on the other hand, are never under any appreciable pressure and will therefore retain their initial accuracy indefinitely.

The new Pratt & Whitney No. 1 1/2B Jig Borer is used for boring jigs and fixtures or is equally efficient as a "jig eliminator" on precision boring jobs where there is not time to make jigs or fixtures or where the quantity is too small to warrant making them.

UNIVERSAL Standard DRILL BUSHINGS

The bore of Universal Standard drill bushings is honed, assuring exceptional wearing qualities. Wear tests of honed surfaces show a life increase of 50 to 300%. **UNIVERSAL BUSHINGS SAVE YOU 10% IN FIRST COST.**

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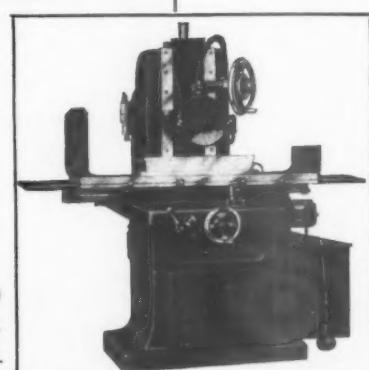
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Removes the guess
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16

Operations

Precision Boring Machine For Aircraft Engine Work

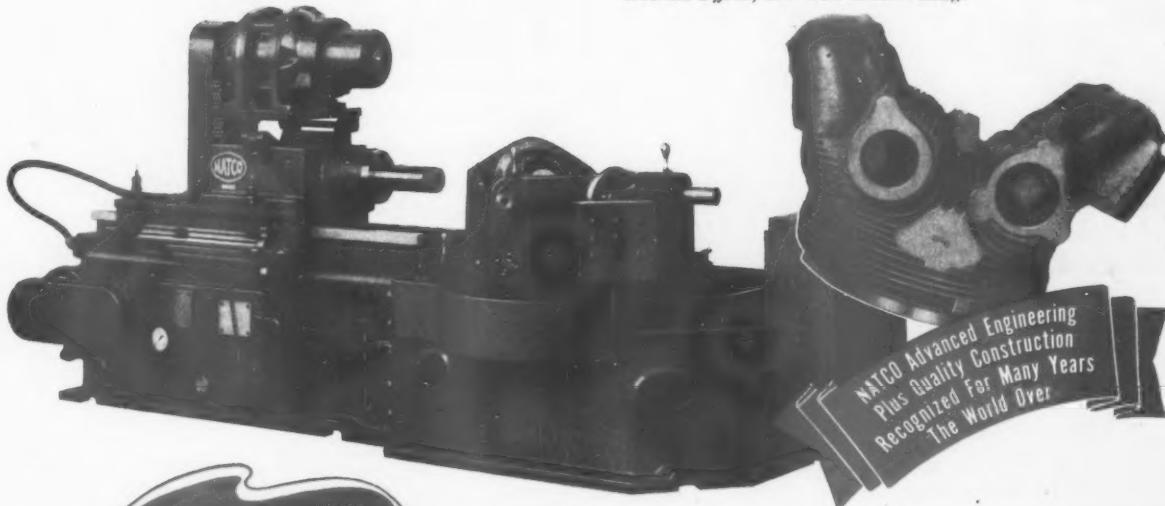
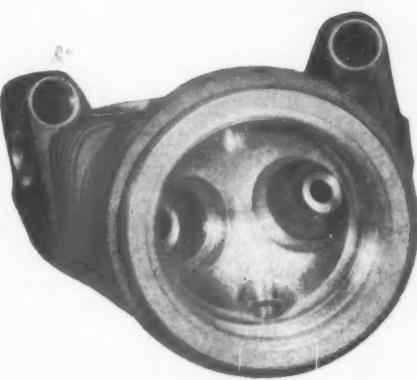
The NATCO Precision Boring Machine illustrated is being used by an Aircraft Engine Manufacturer. It is performing a total of sixteen drilling, end cut boring, counterboring, line boring and line reaming operations on the valve seats and valve guide holes in the aluminum alloy cylinder heads which are also shown.

This machine is built of a NATCO HOLESTEEL FLOOR TYPE UNIT and a two position hand indexed fixture mounted on a steel base. The HOLESTEEL UNIT is arranged with a special head complete with a single stub type precision boring spindle. One set of operations is performed with the fixture in one position and the second set of operations with the fixture in the second position. One operator unloading, loading, changing tools and indexing fixture as required, maintains a production of from eight to ten cylinder heads per hour.

Write for literature or call a NATCO representative. Let him aid you in coming to a practical and economical solution to your "Precision Boring" problems.

THE NATIONAL AUTOMATIC TOOL COMPANY
Richmond, Indiana, U. S. A.

Chicago Office, 2009 Engineering Bldg.
Detroit Office, 409 New Center Bldg.



Investigate
NATCO Methods for
Lower 'Hole'
Costs!

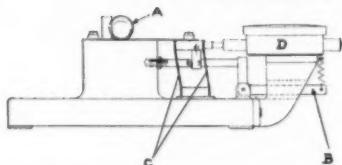
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DRILLING, BORING and TAPPING MACHINES



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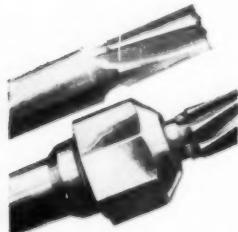


Any cylindrical object can be checked for circumference by simply inserting it within the steel loop *A*. Relieving spring tension at *B*, allows steel loop to be pulled taut around cylinder by pantograph spring *C*. Reading is made in indicator *D*. Model 1315

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Special High Production Machinery

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Steel Construction throughout.
Positive Quick-Acting Air Control Valve.
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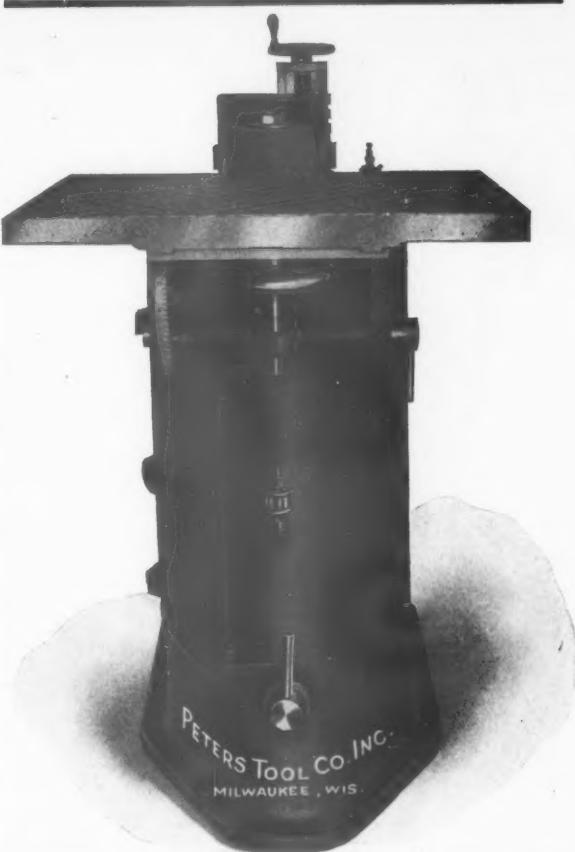


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Eliminate belt slippage and power loss because the belt is sealed to pulley at vacuum contacts . . . increase life of belts and equipment . . . enable machines to take larger cuts and operate at maximum capacity . . . wear indefinitely . . . keep belts from flying off . . . Sizes from 2" up to 72" . . . recommended for short center drives . . . Try one at our risk on your worst drive.

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Peters Vertical Oscillatory Grinders

- Designed to give a fast precision machine operation.
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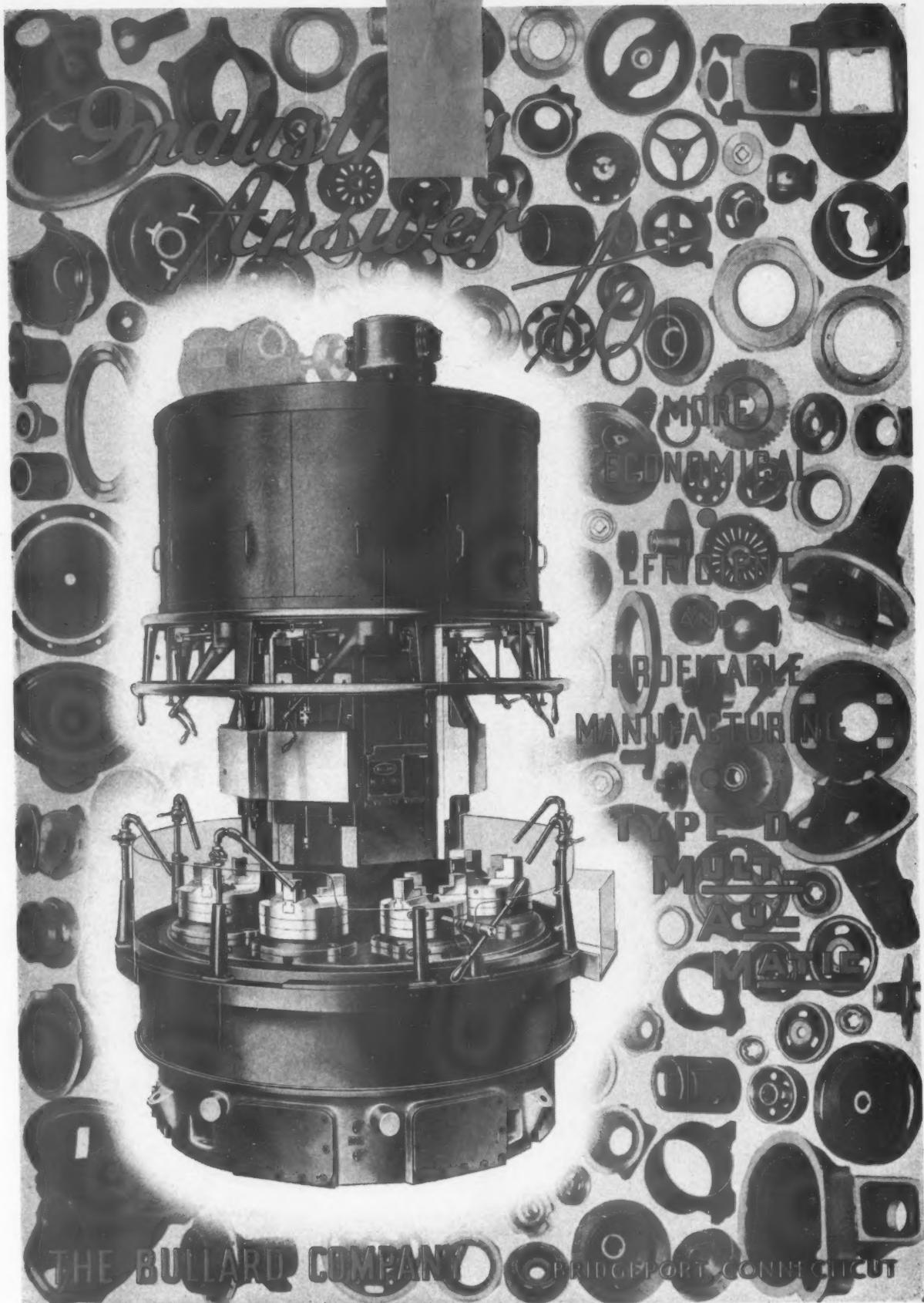
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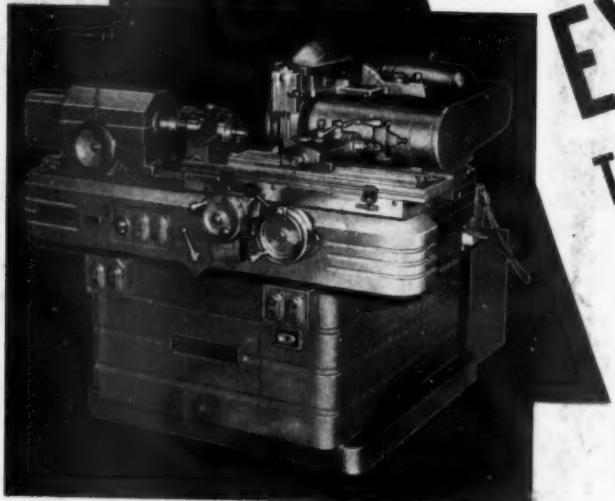
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TAKE A TIP from the TAP MAKER

The product of the tap maker has to be more accurate—do more work—and stand up under more gueling conditions than any threaded product on the market—yet must be produced at competitive prices. Leading tap makers the country over have found that these requirements are best met when their product is produced by grinding **after hardening**—and experience has also taught them that Ex-Cell-O Precision Thread Grinders are the most economical and satisfactory machines for this work.

Manufacturers of other threaded parts who require extreme accuracy, smooth finish and durability, will likewise find these machines best for their jobs. The Ex-Cell-O machines Thread Grinder, Style No. 31, will grind an external threaded section 8 inches long, 5 inches diameter. Another Style, No. 35, will grind an external threaded section 92 inches long, 12 inches diameter, or an internal threaded section from 1 inch to 8 inches in diameter, depending on its length.



EX-CELL-O Precision THREAD GRINDERS

EX-CELL-O CORPORATION
1204 OAKMAN BLVD., DETROIT, MICH.